PROJECT APOLLO
Statistical Tables

Extracted from
Apollo By The Numbers: A Statistical Reference
NASA SP-2000-4029
By Richard W. Orloff
With Revisions as of February 2024

NOTE TO THE READER

The tables on the following pages were originally included in my work, ***Apollo by the Numbers: A Statistical Reference***, published in 2000 by NASA as part of their History Series (SP-2000-4029. This extract from that work was created to provide a statistical supplement to:

Apollo Lunar Surface Journal, created by Dr. Eric M. Jones and now edited by Kenneth Glover

Apollo Flight Journal, created and edited by W. David Woods.

The original mission narratives from my book are not included here because those two websites provide a more detailed and current resource for persons interested in Project Apollo. The bibliography at the end of this file includes only the resources consulted for the data tables, not for the mission narratives.

Please note that, over the past two decades, some of the tables from ***Apollo by the Numbers*** required modifications, all of which are reflected here.

My thanks to David Woods and Ken Glover for agreeing to link these tables to their websites, and especially to Stephen Garber of the NASA History Office for his encouragement and support.

Richard W. Orloff
February 2024

APOLLO 7

The First Mission:
Testing the CSM in Earth Orbit
11 October-22 October 1968

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 7 Spacecraft History[1]

Event	Date
Individual and combined CM and SM systems test completed at factory.	18 Mar 1968
Saturn S-IB stage delivered to KSC.	28 Mar 1968
Saturn S-IVB stage delivered to KSC.	07 Apr 1968
Saturn S-IB instrument unit delivered to KSC.	11 Apr 1968
Integrated CM and SM systems test completed at factory.	29 Apr 1968
CM #101 and SM #101 ready to ship from factory to KSC.	29 May 1968
CM #101 and SM #101 delivered to KSC.	30 May 1968
CM #101 and SM #101 mated.	11 Jun 1968
CSM #101 combined systems test completed.	19 June 1968
CSM #101 altitude tests completed.	29 Jul 1968
Space vehicle moved to launch complex 34.	09 Aug 1968
CSM #101 integrated systems test completed.	27 Aug 1968
CSM #101 electrically mated to launch vehicle.	20 Aug 1968
Space vehicle overall test completed.	04 Sep 1968
Space vehicle countdown demonstration test completed.	17 Sep 1968
Space vehicle flight readiness test completed.	25 Sep 1968

Apollo 7 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff[2]	000:00:00.36	0.019	0.000	0.0	1,341.7		28.3608	-80.5611	0.06	90.01
Mach 1 achieved	000:01:02.15	4.120	0.753	1,039.1	1,960.1		28.3649	-80.5477	29.63	86.70
Maximum dynamic pressure	000:01:18.5	6.567	1.933	1,459.4	2,408.8		28.3708	-80.5264	31.64	83.65
S-IB center engine cutoff	000:02:20.65	30.626	29.184	6,264.7	7,394.5	123.64	28.5090	-80.0349	27.09	75.87
S-IB outboard engine cutoff	000:02:24.32	32.678	32.418	6,479.1	7,616.8	147.31	28.5252	-79.9765	26.55	75.78
S-IB/S-IVB separation[3]	000:02:25.59	33.389	33.561	6,472.1	7,612.6		28.5310	-79.9558	26.32	75.79
S-IVB engine cutoff	000:10:16.76	123.167	983.290	24,181.2	25,525.9	469.79	31.3633	-61.9777	0.00	85.91
Earth orbit insertion	000:10:26.76	123.177	1,121.743	24,208.5	25,553.2		31.4091	-61.2293	0.005	86.32

1 There are conflicts in NASA literature regarding the history of Apollo hardware. Where conflicts exist, the author has used the dates that appear to be most logical. The sources for these events are: Apollo Program Summary Report (JSC-09423); Stages To Saturn: A Technological History of Saturn/Apollo Launch Vehicles (SP-4206); and the Saturn V Flight Evaluation Report for each mission.

2 Altitude on the launch pad is measured at the instrument unit for all Apollo missions.

3 Only the commanded time is available for this event.

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 7 Earth Orbit Phase[4]

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:10:26.76	25,553.2			152.34	123.03	89.553	1.608
Separation of CSM from S-IVB	002:55:02.40	25,499.5			170.21	123.01	89.943	1.640
1st rendezvous phasing ignition	003:20:09.9	25,531.7			167.0	125.3	89.99	31.61
1st rendezvous phasing cutoff	003:20:26.2	25,525.0	16.3	5.7	165.2	124.8	89.95	31.62
2nd rendezvous phasing ignition	015:52:00.9	25,283.1			165.1	124.7	89.95	31.62
2nd rendezvous phasing cutoff	015:52:18.5	25,277.4	17.6	7.0	164.7	120.8	89.86	31.62
1st SPS ignition	026:24:55.66	25,289.9			164.6	120.6	89.86	31.62
1st SPS cutoff	026:25:05.02	25,354.0	9.36	204.1	194.1	123.0	90.57	31.62
2nd SPS ignition	028:00:56.47	25,446.5			194.1	123.0	90.57	31.62
2nd SPS cutoff	028:01:04.23	25,357.2	7.76	173.8	153.6	113.9	89.52	31.63
Terminal phase initiation ignition	029:16:33	25,327.1			153.6	113.9	89.52	31.63
Terminal phase initiation cutoff	029:17:19		46	17.7				
Terminal phase finalize (braking)	029:43:55				154.1	121.6	89.68	31.61
Terminal phase end	029:55:43	25,546.1	708	49.1	161.0	122.1	89.82	31.61
Separation ignition	030:20:00.0	25,514.1			161.0	122.1	89.82	31.61
Separation cutoff	030:20:05.4	25,515.1	5.4	2.0	161.0	122.2	89.82	31.61
3rd SPS ignition	075:48:00.27	25,326.1			159.4	121.3	89.77	31.61
3rd SPS cutoff	075:48:09.37	25,273.9	9.10	209.7	159.7	89.5	89.17	31.23
4th SPS ignition	120:43:00.44	25,661.2			149.4	87.5	88.94	31.25
4th SPS cutoff	120:43:00.92	25,670.6	0.48	12.3	156.7	89.1	89.11	31.24
5th SPS ignition	165:00:00.42	25,519.3			146.5	87.1	88.88	31.25
5th SPS cutoff	165:01:07.37	25,714.9	66.95	1,691.3	244.2	89.1	90.77	30.08
6th SPS ignition	210:07:59.99	25,354.7			234.8	88.5	90.59	30.08
6th SPS cutoff	210:08:00.49	25,354.6	0.50	14.2	234.6	88.4	90.58	30.07
7th SPS ignition	239:06:11.97	25,864.6			228.3	88.4	90.24	30.07
7th SPS cutoff	239:06:19.67	25,866.4	7.70	220.1	229.8	88.5	90.48	29.87
8th SPS ignition (deorbit)	259:39:16.36	25,155.3			225.3	88.2	90.39	29.88
8th SPS cutoff	259:39:28.15	24,966.5	11.79	343.6				

4 Apollo 7 Mission Report (MSC-PA-R-68-15).

APOLLO 8

The Second Mission:
Testing the CSM in Lunar Orbit
21 December–27 December 1968

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 8 Spacecraft History

Event	Date
Saturn S-II stage #3 delivered to KSC.	26 Dec 1967
Saturn S-IC stage #3 delivered to KSC.	27 Dec 1967
Saturn S-IC stage #3 erected on MLP #1; S-IVB stage #503 delivered to KSC.	30 Dec 1967
Saturn V instrument unit #503 delivered to KSC.	04 Jan 1968
BP-30 delivered to KSC.	06 Jan 1968
Lunar test article B delivered to KSC.	09 Jan 1968
Lunar test article B mated to spacecraft/LM adapter.	19 Jan 1968
Saturn S-II stage #3 erected.	31 Jan 1968
Saturn S-IVB stage #503 erected.; Saturn V instrument unit #503 erected.	01 Feb 1968
Boilerplate payload (BP-30) and summary launch escape system erected.	05 Feb 1968
Launch vehicle electrically mated.	12 Feb 1968
Space vehicle overall test #1 completed (for unmanned mission).	11 Mar 1968
Space vehicle pull test completed (for unmanned mission).	25 Mar 1968
Space vehicle overall test #2 completed (for unmanned mission).	08 Apr 1968
Decision made to de-erect boilerplate payload (BP-30) for service propulsion system skirt modifications.	10 Apr 1968
C mission changed to C prime mission.	27 Apr 1968
Spacecraft/LM adapter #11, instrument unit #503 and Saturn S-IVB stage #503 de-erected.	28 Apr 1968
Saturn S-II stage #3 de-erected.	29 Apr 1968
Saturn S-II stage #3 departed for Mississippi Test Facility for man-rating tests.	01 May 1968
Individual and combined CM and SM systems test completed at factory.	02 Jun 1968
LM descent stage #3 delivered to KSC.	09 Jun 1968
LM ascent stage #3 delivered to KSC.	14 Jun 1968
Saturn S-II stage #3 delivered to KSC from Mississippi Test Facility.	27 Jun 1968
Integrated CM and SM systems test completed at factory.	21 Jul 1968
Saturn S-II stage #3 re-erected.	24 Jul 1968
CSM #103 quads delivered to KSC.	06 Aug 1968
CM #103 and SM #103 ready to ship from factory to KSC; SM #103 delivered to KSC.	11 Aug 1968
CM #103 delivered to KSC.	12 Aug 1968
Saturn S-IVB stage #503 erected.	14 Aug 1968
Saturn V instrument unit #503 erected.	15 Aug 1968
Facility verification vehicle erected.	16 Aug 1968
AS-503 designated Apollo 8. Decision made to replace LM with spacecraft/LM adapter and lunar test article B.	19 Aug 1968
CM #103 and SM #103 mated.	22 Aug 1968
Launch vehicle electrical systems test completed.	23 Aug 1968
CSM #103 combined systems test completed.	05 Sep 1968
Facility verification vehicle de-erected.	14 Sep 1968
BP-30 erected for service arm checkout.	15 Sep 1968
Spacecraft/LM adapter #11 delivered to KSC.	18 Sep 1968
CSM #103 altitude tests completed.	22 Sep 1968

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Lunar test article B mated with spacecraft/LM adapter.	29 Sep 1968
Service arm overall test completed.	02 Oct 1968
BP-30 de-erected.	04 Oct 1968
CSM #103 moved to VAB	07 Oct 1968
Space vehicle and MLP #1 transferred to launch complex 39A.	09 Oct 1968
Mobile service structure transferred to launch complex 39A.	12 Oct 1968
Space vehicle cutoff and malfunction test completed.	22 Oct 1968
CSM #103/Mission Control Center Houston test completed.	29 Oct 1968
CSM #103 integrated systems test completed.	02 Nov 1968
CSM #103 electrically mated to launch vehicle.	04 Nov 1968
Space vehicle electrically mated.	05 Nov 1968
Space vehicle overall test completed.	06 Nov 1968
Space vehicle overall test #1 (plugs in) completed.	07 Nov 1968
Launch vehicle/Mission Control Center Houston test completed.	11 Nov 1968
Launch umbilical tower/pad water system test completed.	12 Nov 1968
Space vehicle flight readiness test completed.	19 Nov 1968
Space vehicle hypergolic fuel loading completed.	30 Nov 1968
Saturn S-IC stage #3 RP-1 fuel loading completed.	02 Dec 1968
Space vehicle countdown demonstration test (wet) completed.	10 Dec 1968
Space vehicle countdown demonstration test (dry) completed.	11 Dec 1968

Apollo 8 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.67	0.032	0.000	2.2	1,340.7		28.4470	-80.6041	0.00	90.00
Mach 1 achieved	000:01:01.45	3.971	1.297	1,076.3	2,078.4		28.4526	-80.5805	26.79	85.21
Maximum dynamic pressure	000:01:18.9	7.252	3.545	1,735.4	2,754.7		28.4645	-80.5398	29.56	82.43
S-IC center engine cutoff*	000:02:05.93	22.398	22.704	5,060.1	6,213.78	132.52	28.5581	-80.1934	24.527	76.572
S-IC outboard engine cutoff	000:02:33.82	35.503	48.306	7,698.0	8,899.77	160.41	28.6856	-79.7302	20.699	75.387
S-IC/S-II separation*	000:02:34.47	35.838	49.048	7,727.36	8,930.15		28.6893	-79.7168	20.605	75.384
S-II engine cutoff	000:08:44.04	103.424	812.267	21,055.6	22,379.1	367.85	31.5492	-65.3897	0.646	81.777
S-II/S-IVB separation*	000:08:44.90	103.460	815.159	21,068.14	22,391.60		31.5565	-65.3338	0.636	81.807
S-IVB 1st burn cutoff	000:11:24.98	103.324	1,391.631	24,238.3	25,562.43	156.69	32.4541	-54.0565	-0.001	88.098
Earth orbit insertion	000:11:34.98	103.326	1,430.363	24,242.9	25,567.06		32.4741	-53.2923	0.0006	88.532

*Only the commanded time is available for this event.

Apollo 8 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:11:34.98	25,567.06			99.99	99.57	88.19	32.509
S-IVB 2nd burn ignition	002:50:37.79	25,558.6						
S-IVB 2nd burn cutoff	002:55:55.51	35,532.41	317.72	9,973.81				30.639

Apollo 8 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	002:56:05.51	187.221	35,505.41			7.897	67.494
CSM separated from S-IVB	003:20:59.3	3,797.775	24,974.90			45.110	107.122
Midcourse correction ignition	010:59:59.2	52,768.4	8,187			73.82	120.65
Midcourse correction cutoff	011:00:01.6	52,771.7	8,172	2.4	20.4	73.75	120.54
Midcourse correction ignition	060:59:55.9	21,064.5	4,101			-84.41	-86.90
Midcourse correction cutoff	061:00:07.8	21,059.2	4,103	11.9	1.4	-84.41	-87.01

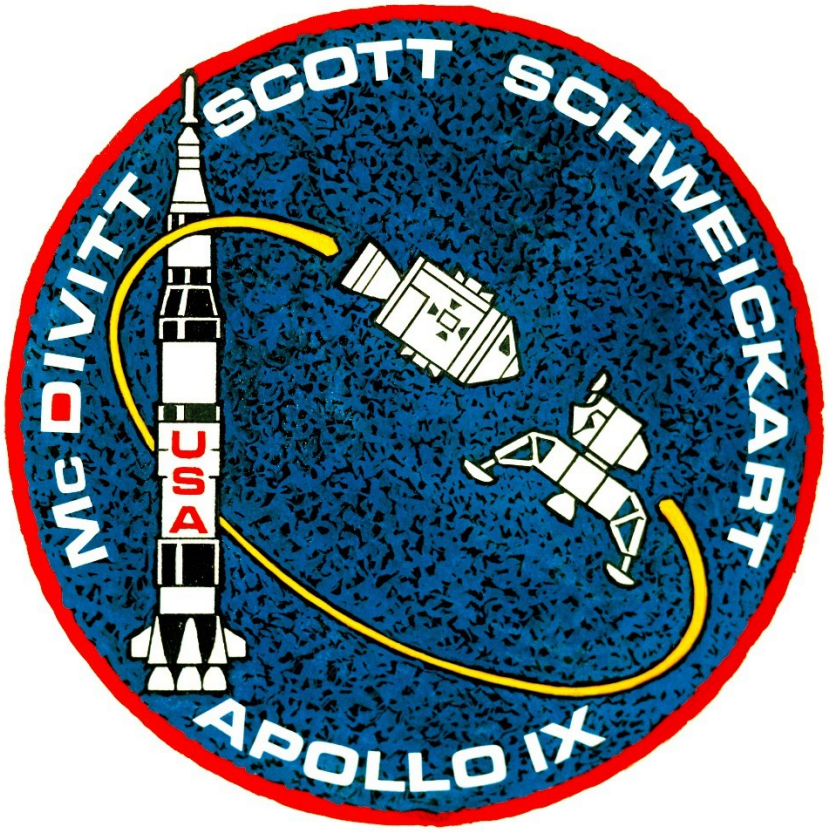
Apollo 8 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	069:08:20.4	75.6	8,391				
Lunar orbit insertion cutoff	069:12:27.3	62.0	5,458	246.9	2,997	168.5	60.0
Lunar orbit circularization ignition	073:35:06.6	59.3	5,479				
Lunar orbit circularization cutoff	073:35:16.2	60.7	5,345	9.6	134.8	60.7	59.7

Apollo 8 Transearth Phase

Event	GET hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	089:19:16.6	60.2	5,342			-0.16	-118.59
Transearth injection cutoff	089:22:40.3	66.1	8,842	203.7	3,519.0	5.10	-115.00
Midcourse correction ignition	103:59:54	165,561.5	4,299			-80.59	52.65
Midcourse correction cutoff	104:00:08	167,552.0	4,298	14	4.8	-80.60	52.65

APOLLO 9



The Third Mission:
Testing the LM in Earth Orbit
3 March–13 March 1969

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 9 Spacecraft History

Event	Date
LM #3 integrated test at factory.	31 Jan 1968
Saturn S-II stage #4 delivered to KSC.	15 May 1968
LM #3 final engineering evaluation acceptance test at factory.	17 May 1968
LM descent stage #3 ready to ship from factory to KSC.	04 Jun 1968
LM descent stage #3 delivered to KSC.	09 Jun 1968
LM ascent stage #3 ready to ship from factory to KSC.	12 Jun 1968
LM ascent stage #3 delivered to KSC.	14 Jun 1968
LM ascent stage #3 and descent stage #3 mated.	30 Jun 1968
LM #3 combined systems test completed.	01 Jul 1968
Individual and combined CM and SM systems test completed at factory.	20 Jul 1968
LM #3 reassigned to Apollo 9.	19 Aug 1968
Integrated CM and SM systems test completed at factory.	31 Aug 1968
Saturn S-IVB stage #504 delivered to KSC.	12 Sep 1968
LM #3 altitude tests completed.	27 Sep 1968
Saturn S-IC stage #4 delivered to KSC.	30 Sep 1968
Saturn V instrument unit #504 delivered to KSC.	30 Sep 1968
CM #104 and SM #104 ready to ship from factory to KSC.	05 Oct 1968
CM #104 and SM #104 delivered to KSC.	05 Oct 1968
CM #104 and SM #104 mated.	08 Oct 1968
CSM #104 combined systems test completed.	24 Oct 1968
CSM #104 altitude tests completed.	18 Nov 1968
CSM #104 mated to space vehicle.	03 Dec 1968
CSM #104 moved to VAB	03 Dec 1968
LM #3 combined systems test completed.	07 Dec 1968
CSM #104 integrated systems test completed.	11 Dec 1968
CSM #104 electrically mated to launch vehicle.	26 Dec 1968
Space vehicle overall test completed.	27 Dec 1968
Space vehicle and MLP #2 transferred to launch complex 39A.	03 Jan 1969
Space vehicle flight readiness test completed.	18 Jan 1969
LM #3 flight readiness test completed.	19 Jan 1969
Space vehicle countdown demonstration test (wet) completed.	11 Feb 1969
Space vehicle countdown demonstration test (dry) completed.	12 Feb 1969
Terminal countdown initiated.	26 Feb 1969
Terminal countdown interrupted due to illness of crew.	27 Feb 1969
Terminal countdown reinitiated following crew medical clearance.	01 Mar 1969

Apollo 9 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.67	0.032	000.0	1.8	1,340.7		28.4470	-80.6041	0.08	90.00
Mach 1 achieved	000:01:08.2	4.243	1.383	1,088.4	2,100.7		28.4545	-80.5794	26.35	84.50
Maximum dynamic pressure	000:01:25.5	7.429	3.789	1,737.7	2,783.2		28.4666	-80.5369	28.08	81.87
S-IC center engine cutoff*	000:02:14.34	22.459	24.602	5,154.1	6,329.49	140.64	28.5720	-80.1602	22.5766	76.420
S-IC outboard engine cutoff	000:02:42.76	34.808	51.596	7,793.3	9,013.71	169.06	28.7071	-79.6718	18.5394	75.335
S-IC/S-II separation*	000:02:43.45	35.144	52.410	7,837.89	9,059.28		28.7111	-79.6571	18.449	75.337
S-II engine cutoff	000:08:56.22	100.735	830.505	21,431.9	22,753.54	371.06	31.6261	-65.0422	0.9177	81.872
S-II/S-IVB separation*	000:08:57.18	100.794	833.794	21,440.5	22,762.27		31.6343	-64.9786	0.906	81.907

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S-IVB 1st burn cutoff	000:11:04.66	103.156	1,296.775	24,240.6	25,563.98	123.84	32.4266	-55.9293	-0.0066	86.979
Earth orbit insertion	000:11:14.66	103.154	1,335.515	24,246.39	25,569.78		32.4599	-55.1658	-0.0058	87.412

* Only the commanded time is available for this event.

Apollo 9 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:11:14.66	25,569.78			100.74	99.68	88.20	32.552
CSM separated from S-IVB	002:41:16.0	25,553						
CSM/LM ejected from S-IVB	004:08:09	25,565.3						
S-IVB 2nd burn restart*	004:45:55.54	25,556.1						
S-IVB 2nd burn cutoff	004:46:57.60	27,742.03	62.06					32.303
S-IVB intermediate orbit insertion	004:47:07.60	27,753.61			1,671.58	105.75	119.22	32.302
1st SPS ignition	005:59:01.07	25,549.8						
1st SPS cutoff	005:59:06.30	25,583.8	5.23	36.6	127.6	111.3	88.8	32.56
S-IVB 3rd burn restart*	006:07:19.26	20,766.0						
S-IVB 3rd burn cutoff	006:11:21.32	31,589.17	242.06					33.824
S-IVB escape orbit insertion	006:11:31.32	31,619.85						33.825
2nd SPS ignition	022:12:04.07	25,588.2						
2nd SPS cutoff	022:13:54.36	25,701.7	110.29	850.5	192.5	110.7	90.0	33.46
3rd SPS ignition	025:17:39.27	25,692.4						
3rd SPS cutoff	025:22:19.15	25,794.3	279.88	2567.9	274.9	112.6	91.6	33.82
4th SPS ignition	028:24:41.37	25,807.7						
4th SPS cutoff	028:25:09.24	25,798.9	27.87	300.5	275.0	112.4	91.6	33.82
DPS docked ignition	049:41:34.46	25,832.7						
DPS docked cutoff	049:47:45.97	25,783.0	371.51	1737.5	274.6	112.1	91.5	33.97
5th SPS ignition	054:26:12.27	25,700.8						
5th SPS cutoff	054:26:55.53	25,473.2	43.26	572.5	131.0	125.9	89.2	33.61
CSM/LM separation ignition	093:02:54	25,480.5						
CSM/LM separation cutoff	093:03:03.5	25,480.5	9.5		127	122		
LM descent phasing ignition	093:47:35.4	25,518.9						
LM descent phasing cutoff	093:47:54.4	25,518.2	19.0		137	112		
LM descent insertion ignition	095:39:08.06	25,412.6						
LM descent insertion cutoff	095:39:30.43	25,453.0	22.37		138.9	133.9		
LM coelliptic sequence ignition	096:16:06.54	25,452.0						
LM coelliptic sequence cutoff	096:16:38.25	25,412.0	31.71		138	113		
LM constant differential height ignition	096:58:15.0	25,592.0						
LM constant differential height cutoff	096:58:17.9	25,550.6	2.9		116	111		
LM terminal phase initiation ignition	097:57:59	25,540.8						
LM terminal phase initiation cutoff	097:58:36.6	25,560.5	37.6		126	113		
LM ascent engine depletion ignition	101:53:15.4	25,480.3						
LM ascent engine depletion	101:59:17.7	29,415.4	362.3	5,373.4	3,760.9	126.6	165.3	28.95
6th SPS ignition	123:25:06.97	25,522.2						
6th SPS cutoff	123:25:08.40	25,489.0	1.43	33.7	123.1	108.5	88.7	33.62
7th SPS ignition	169:39:00.36	25,589.6						
7th SPS cutoff	169:39:25.26	25,825.9	24.90	650.1	253.2	100.7	90.9	33.51
8th SPS ignition	240:31:14.84	25,318.4						
8th SPS cutoff	240:31:26.58	25,142.8	11.74	322.7	240.0	-4.2	88.8	33.52

* Only the commanded time is available for this event.

APOLLO 10

The Fourth Mission:
Testing the LM in Lunar Orbit
18 May–26 May 1969

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 10 Spacecraft History

Event	Date
LM #4 integrated test at factory.	25 May 1968
Individual and combined CM and SM systems test completed at factory.	08 Sep 1968
LM #4 final engineering evaluation acceptance test at factory.	02 Oct 1968
LM descent stage #4 ready to ship from factory to KSC.	09 Oct 1968
LM descent stage #4 delivered to KSC.	11 Oct 1968
LM ascent stage #4 ready to ship from factory to KSC.	12 Oct 1968
LM ascent stage #4 delivered to KSC.	16 Oct 1968
Integrated CM and SM systems test completed at factory.	19 Oct 1968
LM ascent stage #4 and descent stage #4 mated.	02 Nov 1968
LM #4 combined systems test completed.	06 Nov 1968
CM #106 and SM #106 ready to ship from factory to KSC.	24 Nov 1968
CM #106 and SM #106 delivered to KSC.	25 Nov 1968
CM #106 and SM #106 mated.	26 Nov 1968
Saturn S-IC stage #5 delivered to KSC.	27 Nov 1968
Saturn S-II stage #5 delivered to KSC.	03 Dec 1968
Saturn S-IVB stage #505 delivered to KSC.	10 Dec 1968
LM #4 altitude tests completed.	06 Dec 1968
Saturn V instrument unit #505 delivered to KSC.	15 Dec 1968
CSM #106 combined systems test completed.	16 Dec 1968
Launch vehicle erected.	30 Dec 1968
CSM #106 altitude tests completed.	17 Jan 1969
Launch vehicle propellant dispersion/malfunction overall test completed.	03 Feb 1969
CSM #106 moved to VAB	06 Feb 1969
Spacecraft erected.	06 Feb 1969
LM #4 combined systems test completed.	10 Feb 1969
CSM #106 integrated systems test completed.	13 Feb 1969
CSM #106 electrically mated to launch vehicle.	27 Feb 1969
Space vehicle overall test completed.	03 Mar 1969
Space vehicle overall test #1 (plugs in) completed.	05 Mar 1969
Space vehicle and MLP #3 transferred to launch complex 39B.	11 Mar 1969
LM #4 flight readiness test completed.	27 Mar 1969
Emergency egress test completed.	28 Mar 1969
Space vehicle flight readiness test completed.	19 Apr 1969
Space vehicle hypergolic fuel loading completed.	25 Apr 1969
Saturn S-IC stage #5 RP-1 fuel loading completed.	02 May 1969
Space vehicle countdown demonstration test (wet) completed.	05 May 1969
Space vehicle countdown demonstration test (dry) completed.	06 May 1969

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 10 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.58	0.035	0.000	1.3	1,340.4		28.4658	-80.6209	0.06	90.00
Mach 1 achieved	000:01:06.8	4.244	1.037	1,057.9	2,028.6		28.4714	-80.6023	27.82	85.03
Maximum dynamic pressure	000:01:22.6	7.137	2.893	1,623.4	2,645.8		28.4813	-80.5690	28.83	82.23
S-IC center engine cutoff*	000:02:15.16	23.430	25.009	5,299.0	6,473.20	141.56	28.5967	-80.1577	22.807	76.461
S-IC outboard engine cutoff	000:02:41.63	35.247	50.419	7,810.2	9,028.58	168.03	28.7182	-79.7090	18.946	75.538
S-IC/S-II separation*	000:02:42.31	35.580	51.223	7,833.4	9,052.79		28.7222	-79.6943	18.848	75.538
S-II center engine cutoff	000:07:40.61	96.710	599.079	17,310.1	18,630.15	296.56	30.9579	-69.4941	1.029	79.585
S-II outboard engine cutoff	000:09:12.64	101.204	883.670	21,309.9	22,632.02	388.59	31.7505	-64.0222	0.741	82.458
S-II/S-IVB separation	000:09:13.50	101.247	886.634	21,317.8	22,639.93		31.7574	-63.9647	0.730	82.490
S-IVB 1st burn cutoff*	000:11:43.76	103.385	1,430.977	24,238.8	25,562.40	146.95	32.5150	-53.2920	-0.0064	88.497
Earth orbit insertion	000:11:53.76	103.334	1,469.790	24,244.3	25,567.88		32.5303	-52.5260	-0.0049	89.933

*Only the commanded time is available for this event.

Apollo 10 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclin-ation (deg)
Earth orbit insertion	000:11:53.76	25,567.88		100.32	99.71	88.20	32.546
S-IVB 2nd burn ignition	002:33:27.52	25,561.4					
S-IVB 2nd burn cutoff	002:39:10.58	35,585.83	343.06				31.701

Apollo 10 Translunar Phase

	GET	Altitude	Space Fixed Velocity	Event Duration	Velocity Change	Space Fixed Flight Path Angle	Space Fixed Heading Angle

Event	(hhh:mm:ss)	(n mi)	(ft/sec)	(sec)	(ft/sec)	(deg)	(E of N)
Translunar injection	002:39:20.58	179.920	35,562.96			7.379	61.065
CSM separated from S-IVB (ignition)	003:02:42.4	3,502.626	25,548.72			43.928	67.467
CSM SPS evasive maneuver ignition	004:39:09.8	17,938.5	14,220.2			65.150	91.21
CSM SPS evasive maneuver cutoff	004:39:12.7	17,944.7	14,203.7	2.9	18.8	65.100	91.22
Midcourse correction ignition	026:32:56.8	110,150.2	5,094.4			77.300	108.36
Midcourse correction cutoff	026:33:03.9	110,155.9	5,110.0	7.1	49.2	77.800	108.92

Apollo 10 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	075:55:54.0	95.1	8,232.3				
Lunar orbit insertion cutoff	076:01:50.1	61.2	5,471.9	356.1	2,982.4	170.0	60.2
Lunar orbit circularization ignition	080:25:08.1	60.4	5,484.7				
Lunar orbit circularization cutoff	080:25:22.0	59.3	5,348.9	13.9	139.0	61.0	59.2
CSM/LM undocked	098:11:57	58.1	5,357.8				
CSM/LM separation ignition	098:47:17.4	59.2	5,352.2				
CSM/LM separation cutoff	098:47:25.7	59.2	5,352.1	8.3	2.5	62.9	57.7
LM descent orbit insertion ignition	099:46:01.6	61.6	5,339.6				
LM descent orbit insertion cutoff	099:46:29.0	61.2	5,271.2	27.4	71.3	60.9	8.5
LM closest approach to lunar surface	100:41:43	7.8					
LM phasing ignition	100:58:25.93	17.7	5,212.4				
LM phasing cutoff	100:59:05.88	19.0	5,672.9	39.95	176.0	190.1	12.1
LM ascent stage/descent stage separated	102:45:16.9	31.4	5,605.6				
LM ascent orbit insertion ignition	102:55:02.13	11.6	5,705.2				
LM ascent orbit insertion cutoff	102:55:17.68	11.7	5,520.6	15.55	220.9	46.5	11.0
LM coelliptic sequence initiation ignition	103:45:55.3	44.7	5,335.5				
LM coelliptic sequence initiation cutoff	103:46:22.6	44.6	5,381.7	27.3	45.3	48.7	40.7
LM constant differential height ignition	104:43:53.28	44.3	5,394.7				
LM constant differential height cutoff	104:43:54.93	43.8	5,394.9	1.65	3.0	48.8	42.1
LM terminal phase initiation ignition	105:22:55.58	48.4	5,369.2				
LM terminal phase initiation cutoff	105:23:12.08	47.0	5,396.7	16.50	24.1	58.3	46.8
LM 1st midcourse correction	105:37:56				1.27		
LM 2nd midcourse correction	105:52:56				1.84		
LM braking	106:05:49				31.6	63.3	56.4
CSM/LM docked	106:22:02	54.7	5,365.9				
LM separation ignition	108:43:23.3	57.3	5,352.3				
LM separation cutoff	108:43:29.8	57.6	5,352.1	6.5	2.1	64.0	56.3
LM ascent propulsion system ignition	108:52:05.5	59.1	5,343.0				
LM ascent propulsion system depletion	108:56.14.5	89.7	9,056.4	249.0	4,600.0	-2,211.6	56.2

Apollo 10 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	137:36:28.9	56.0	5,362.7			-0.44	-73.60
Transearth injection cutoff	137:39:13.7	56.5	8,987.2	164.8	3,680.3	2.53	-76.68
Midcourse correction ignition	188:49:58.0	25,570.4	12,540.0			-69.65	119.34
Midcourse correction cutoff	188:50:04.7	25,557.4	12,543.5	6.7	2.2	-69.64	119.34

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

APOLLO 11

The Fifth Mission
The First Lunar Landing
16 July–24 July 1969

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 11 Spacecraft History

Event	Date
Individual and combined CM and SM systems test completed at factory.	12 Oct 1968
LM #5 integrated test at factory.	21 Oct 1968
Integrated CM and SM systems test completed at factory.	06 Dec 1968
LM #5 final engineering evaluation acceptance test at factory.	13 Dec 1968
LM ascent stage #5 ready to ship from factory to KSC.	07 Jan 1969
LM ascent stage #5 delivered to KSC.	08 Jan 1969
Spacecraft/LM adapter #14 delivered to KSC.	10 Jan 1969
LM descent stage #5 ready to ship from factory to KSC.	11 Jan 1969
LM descent stage #5 delivered to KSC.	12 Jan 1969
CSM #107 quads delivered to KSC.	15 Jan 1969
Saturn S-IVB stage #506 delivered to KSC.	19 Jan 1969
CM #107 and SM #107 ready to ship from factory to KSC.	22 Jan 1969
CM #107 and SM #107 delivered to KSC.	23 Jan 1969
CM #107 and SM #107 mated.	29 Jan 1969
Saturn S-II stage #6 delivered to KSC.	06 Feb 1969
LM ascent stage #5 and descent stage #5 mated.	14 Feb 1969
CSM #107 combined systems test completed.	17 Feb 1969
LM #5 combined systems test completed.	17 Feb 1969
Saturn S-IC stage #6 delivered to KSC.	20 Feb 1969
Saturn S-IC stage #6 erected.	21 Feb 1969
Saturn V instrument unit #506 delivered to KSC.	27 Feb 1969
Saturn S-II stage #6 erected.	04 Mar 1969
Saturn S-IVB stage #506 erected.	05 Mar 1969
Saturn V instrument unit #506 erected.	05 Mar 1969
CSM #107 altitude test with prime crew completed.	18 Mar 1969
LM #5 altitude test with prime crew completed.	21 Mar 1969
CSM #107 altitude tests completed.	24 Mar 1969
LM #5 altitude tests completed.	25 Mar 1969
Launch vehicle propellant dispersion/malfunction overall test completed.	27 Mar 1969
CSM #107 moved to VAB	14 Apr 1969
Spacecraft erected.	14 Apr 1969
LM #5 combined systems test completed.	18 Apr 1969
CSM #107 integrated systems test completed.	22 Apr 1969
CSM #107 electrically mated to launch vehicle.	05 May 1969
Space vehicle overall test completed.	06 May 1969
Space vehicle overall test #1 (plugs in) completed.	14 May 1969
Space vehicle and MLP #1 transferred to launch complex 39A.	20 May 1969
Mobile service structure transferred to launch complex 39A.	22 May 1969
LM #4 flight readiness test completed.	02 Jun 1969
Space vehicle flight readiness test completed.	06 Jun 1969
Saturn S-IC stage #6 RP-1 fuel loading completed.	25 Jun 1969
Space vehicle countdown demonstration test (wet) completed.	02 Jul 1969
Space vehicle countdown demonstration test (dry) completed.	03 Jul 1969

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 11 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.63	0.032	0.000	1.5	1,340.7		28.4470	-80.6041	0.06	90.00
Mach 1 achieved	000:01:06.3	4.236	1.044	1,054.1	2,023.9		28.4523	-80.5853	27.88	85.32
Maximum dynamic pressure	000:01:23.0	7.326	3.012	1,653.4	2,671.9		28.4624	-80.5499	29.23	82.41
S-IC center engine cutoff*	000:02:15.2	23.761	25.067	5,320.8	6,492.8	141.6	28.5739	-81.1517	22.957	76.315
S-IC outboard engine cutoff	000:02:41.63	35.701	50.529	7,851.9	9,068.6	168.03	28.7007	-79.6908	19.114	75.439
S-IC/S-II separation*	000:02:42.30	36.029	51.323	7,882.9	9,100.6		28.7046	-79.6764	19.020	75.436
S-II center engine cutoff	000:07:40.62	97.280	601.678	17,404.8	18,725.5	296.62	30.9513	-69.4309	0.897	79.646
S-II outboard engine cutoff	000:09:08.22	101.142	873.886	21,368.2	22,690.8	384.22	31.7089	-64.1983	0.619	82.396
S-II/S-IVB separation*	000:09:09.00	101.175	876.550	21,377.0	22,699.6		31.7152	-64.1467	0.611	82.426
S-IVB 1st burn cutoff	000:11:39.33	103.202	1,421.959	24,237.6	25,561.6	147.13	32.4865	-53.4588	0.011	88.414
Earth orbit insertion	000:11:49.33	103.176	1,460.697	24,243.9	25,567.9		32.5027	-52.6491	0.012	88.848

*Only the commanded time is available for this event.

Apollo 11 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:11:49.33	25,567.8			100.4	98.9	88.18	32.521
S-IVB 2nd burn ignition	002:44:16.20	25,560.2						
S-IVB 2nd burn cutoff	002:50:03.03	35,568.3	346.83	10,008.1				31.386

Apollo 11 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	002:50:13.03	180.581	35,545.6			7.367	60.073
CSM separated from S-IVB	003:15:23.0	3,815.190	24,962.5			45.148	93.758
CSM docked with LM/S-IVB	003:24:03.7	5,317.6	22,662.5			44.94	99.57
CSM/LM evasive maneuver ignition	004:40:01.72	16,620.8	14,680.0			64.30	113.73
CSM/LM evasive maneuver cutoff	004:40:04.65	16,627.3	14,663.0	2.93	19.7	64.25	113.74
Midcourse correction ignition	026:44:58.64	109,475.3	5,025.0			77.05	120.88
Midcourse correction cutoff	026:45:01.77	109,477.2	5,010.0	3.13	20.9	76.88	120.87

Apollo 11 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	075:49:50.37	86.7	8,250.0				
Lunar orbit insertion cutoff	075:55:47.90	60.1	5,479.0	357.53	2917.5	169.7	60.0
Lunar orbit circularization ignition	080:11:36.75	61.8	5,477.3				
Lunar orbit circularization cutoff	080:11:53.63	61.6	5,338.3	16.88	158.8	66.1	54.5
CSM/LM undocked	100:12:00	62.9	5,333.8				
CSM/LM separation ignition	100:39:52.9	62.7	5,332.7				
CSM/LM separation cutoff	100:40:01.9	62.5	5,332.2	9.0	2.7	63.7	56.0
LM descent orbit insertion ignition	101:36:14.0	56.4	5,364.9				
LM descent orbit insertion cutoff	101:36:44.0	57.8	5,284.9	30.0	76.4	64.3	55.6
LM powered descent initiation	102:33:05.01	6.4	5,564.9			58.5	7.8
LM powered descent cutoff	102:45:41.40			756.39			
LM lunar liftoff ignition	124:22:00.79						
LM orbit insertion cutoff	124:29:15.67	10.0	5,537.9	434.88	6,070.1	48.0	9.4
LM coelliptic sequence initiation ignition	125:19:35.0	47.4	5,328.1				
LM coelliptic sequence initiation cutoff	125:20:22.0	48.4	5,376.6	47.0	51.5	49.3	45.7
LM constant differential height ignition	126:17:49.6						
LM constant differential height cutoff	126:18:07.4			17.8	19.9	47.4	42.1
LM terminal phase initiation ignition	127:03:51.8	44.1	5,391.5				
LM terminal phase initiation cutoff	127:04:14.5	44.0	5,413.2	22.7	25.3	61.7	43.7
LM 1st midcourse correction	127:18:30.8				1.0		
LM 2nd midcourse correction	127:33:30.8				1.5		
LM terminal phase finalize ignition	127:46:09.8	7.6	5,339.7				
LM terminal phase finalize cutoff	127:46:38.2			28.4	31.4	63.0	56.5
LM begin braking	127:36:57.3						
LM begin stationkeeping	127:52:05.3						
CSM/LM docked	128:03:00.0	60.6	5,341.5				
LM ascent stage jettisoned	130:09:31.2	61.6	5,335.9				
CSM/LM final separation ignition	130:30:01.0	62.7	5,330.1				
CSM/LM final separation cutoff	130:30:08.1	62.7	5,326.9	7.2	2.2	62.7	54.0

Apollo 11 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	135:23:42.28	52.4	5,376.0			-0.03	-62.77
Transearth injection cutoff	135:26:13.69	58.1	8,589.0	151.41	3,279.0	5.13	-62.60
Midcourse correction ignition	150:29:57.4	169,087.2	4,075.0			-80.34	129.30
Midcourse correction cutoff	150:30:07.4	169,080.6	4,074.0	10.0	4.8	-80.41	129.30
CM/SM separation	194:49:12.7	1,778.3	29,615.5			-35.26	69.27

APOLLO 12

The Sixth Mission:
The Second Lunar Landing

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 12 Spacecraft History

Event	Date
LM #6 integrated test at factory.	31 Dec 1968
Individual and combined CM and SM systems test completed at factory.	20 Jan 1969
Integrated CM and SM systems test completed at factory.	03 Feb 1969
LM #6 final engineering evaluation acceptance test at factory.	18 Feb 1969
Saturn S-IVB stage #507 delivered to KSC.	10 Mar 1969
LM descent stage #6 ready to ship from factory to KSC.	22 Mar 1969
LM ascent stage #6 ready to ship from factory to KSC.	23 Mar 1969
LM ascent stage #6 and LM descent stage #6 delivered to KSC.	24 Mar 1969
CM #108 and SM #108 ready to ship from factory to KSC.	27 Mar 1969
CM #108 and SM #108 delivered to KSC.	28 Mar 1969
CM #108 and SM #108 mated.	02 Apr 1969
CSM #108 combined systems test completed.	21 Apr 1969
Saturn S-II stage #7 delivered to KSC.	21 Apr 1969
LM ascent stage #6 and descent stage #6 mated.	28 Apr 1969
LM #6 combined systems test completed.	01 May 1969
Saturn S-IC stage #7 delivered to KSC.	03 May 1969
Spacecraft/LM adapter #15 delivered to KSC.	06 May 1969
Saturn S-IC stage #7 erected on MLP #2.	07 May 1969
Saturn V instrument unit #507 delivered to KSC.	08 May 1969
Saturn S-II stage #7 erected.	21 May 1969
Saturn S-IVB stage #507 and Saturn V instrument unit #107 erected.	22 May 1969
CSM #108 altitude test with prime crew completed.	07 Jun 1969
CSM #108 altitude tests completed.	09 Jun 1969
CSM #108 altitude test with backup crew completed.	10 Jun 1969
Launch vehicle propellant dispersion/malfunction overall test completed.	12 Jun 1969
LM #6 altitude test with backup crew completed.	13 Jun 1969
LM #6 altitude test with prime crew completed.	16 Jun 1969
Spacecraft moved to VAB.	20 Jun 1969
LM #6 landing gear installed.	22 Jun 1969
LM #6 mated to spacecraft/LM adapter #15.	23 Jun 1969
CSM #108 mated to spacecraft/LM adapter #15.	27 Jun 1969
CSM #108 moved to VAB	30 Jun 1969
Spacecraft erected.	01 Jul 1969
LM #6 combined systems test completed.	05 Jul 1969
CSM #108 integrated systems test completed.	07 Jul 1969
CSM #108 electrically mated to launch vehicle.	16 Jul 1969
Space vehicle overall test completed.	17 Jul 1969
Space vehicle electrically mated.	17 Aug 1969
Space vehicle overall test #1 (plugs in) completed.	21 Aug 1969
Space vehicle and MLP #2 transferred to launch complex 39A.	08 Sep 1969
Mobile service structure transferred to launch complex 39A.	10 Sep 1969
LM #5 flight readiness test completed.	18 Sep 1969
Space vehicle flight readiness test completed.	30 Sep 1969
Saturn S-IC stage #7 RP-1 fuel loading completed.	20 Oct 1969
Space vehicle countdown demonstration test (wet) completed.	28 Oct 1969
Space vehicle countdown demonstration test (dry) completed.	29 Oct 1969

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 12 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.68	0.032	0.000	0.0	1,340.7		28.4470	-80.6041	0.07	90.00
1st lightning strike[5]	000:00:36.5	1.053	0.062	387.9	1,445.7		28.4469	-80.6030	15.40	89.29
2nd lightning strike	000:00:52	2.374	0.399	692.1	1,690.4		28.4487	-80.5968	22.74	87.32
Mach 1 achieved	000:01:06.1	4.215	1.228	1,067.6	2,057.7		28.4532	-80.5820	27.13	84.84
Maximum dynamic pressure	000:01:21.1	6.934	3.019	1,601.4	2,617.3		28.4627	-80.5498	29.02	82.10
S-IC center engine cutoff	000:02:15.24	24.158	25.441	5,334.5	6,494.4	141.7	28.5794	-80.1463	23.944	76.115
S-IC outboard engine cutoff	000:02:41.74	36.773	50.616	7,821.4	9,024.5	168.2	28.7069	-79.6913	20.513	75.231
S-IC/S-II separation	000:02:42.4	37.118	51.338	7,850.3	9,054.2		28.7107	-79.6773	20.430	75.228
S-II center engine cutoff	000:07:40.75	100.463	599.172	17,453.5	18,775.3	297.55	30.9599	-69.4827	0.502	79.632
S-II outboard engine cutoff	000:09:12.34	102.801	884.711	21,508.8	22,831.7	389.14	31.7508	-63.9914	0.442	82.501
S-II/S-IVB separation	000:09:13.20	102.827	887.667	21,517.8	22,840.7		31.7576	-63.9341	0.432	82.533
S-IVB 1st burn cutoff	000:11:33.91	103.093	1,399.874	24,236.6	25,560.2	137.31	32.4933	-53.8956	-0.015	88.146
Earth orbit insertion	000:11:43.91	103.086	1,438.608	24,242.3	25,565.9		32.5128	-53.1311	-0.014	88.580

Apollo 12 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclin-ation (deg)
Earth orbit insertion	000:11:43.91	25,565.9			100.1	97.8	88.16	32.540
S-IVB 2nd burn ignition	002:47:22.80	25,555.4						
S-IVB 2nd burn cutoff	002:53:03.94	35,419.3	341.14	10,515				30.360

Apollo 12 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	002:53:13.94	199.023	35,389.8			8.584	63.902
CSM separated from S-IVB	003:18:04.9	3,819.258	24,865.5			45.092	100.194
CSM docked with LM/S-IVB	003:26:53.3	5,337.7	22,534			49.896	105.29
CSM/LM ejected from S-IVB	004:13:00.9	12,506.3	16,451.1			60.941	114.52
S-IVB APS evasive maneuver	004:29:21.4			80.0	9.5		
Midcourse correction ignition	030:52:44.36	116,929.1	4,317.4			75.833	120.80
Midcourse correction cutoff	030:52:53.55	116,935.4	4,297.5	9.19	61.8	76.597	120.05

5 Data for this event reflects post flight trajectory reconstruction for 36 seconds Ground Elapsed Time.

Apollo 12 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	083:25:23.36	83.91	8,173.6			NA	64.94
Lunar orbit insertion cutoff	083:31:15.61	62.91	5,470.1	352.25	2,889.5	170.20	61.66
Lunar orbit circularization ignition	087:48:48.08	62.79	5,470.6			170.37	61.42
Lunar orbit circularization cutoff	087:49:04.99	62.74	5,331.4	16.91	165.2	66.10	54.59
CSM/LM undocked	107:54:02.3	63.02	5,329.0			63.08	56.91
CSM/LM separation ignition	108:24:36.8	59.22	5,350.0			63.91	56.99
CSM/LM separation cutoff	108:24:51.2	59.15	5,350.5	14.4	2.4	64.06	56.58
LM descent orbit insertion ignition	109:23:39.9	60.52	5,343.0			63.27	57.25
LM descent orbit insertion cutoff	109:24:08.9	61.52	5,268.0	29.0	72.4	61.53	8.70
LM powered descent initiation	110:20:38.1	7.96	5,566.4			62.30	7.96
LM powered descent cutoff	110:32:35.1			717.0			
CSM plane change ignition	119:47:13.23	62.20	5,333.5			62.50	57.61
CSM plane change cutoff	119:47:31.46	62.20	5,683.4	18.23	349.9	62.50	57.60
LM lunar liftoff ignition	142:03:47.78						
LM orbit insertion	142:10:59.9	9.97	5,542.5		6,057	51.93	9.21
LM ascent stage cutoff	142:11:01.78			434			
LM coelliptic sequence initiation ignition	143:01:51.0	51.46	5,310.3			52.51	9.94
LM coelliptic sequence initiation cutoff	143:02:32.1	51.48	5,354.9	41.1	45	51.49	41.76
LM constant differential height ignition	144:00:02.6						
LM constant differential height cutoff	144:00:15.6			13.0	13.8	44.40	40.40
LM terminal phase initiation ignition	144:36:26	44.50	5,382.5			44.73	40.91
LM terminal phase initiation cutoff	144:36:52			26.0	29	60.20	43.80
LM 1st midcourse correction	144:51:29						
LM 2nd midcourse correction	145:06:29						
LM terminal phase finalize ignition	145:19:29.3						
LM terminal phase finalize cutoff	145:20:07.3			38.0	40	62.30	58.30
CSM/LM docked	145:36:20.2	58.14	5,357.1			63.43	58.04
LM ascent stage jettison	147:59:31.6						
CSM/LM separation ignition	148:04:30.9	59.94	5,347.4			64.66	59.08
CSM/LM separation cutoff	148:04:36.3			5.4	1.0	62.00	57.50
LM ascent stage deorbit ignition	149:28:14.8	57.62	5,361.8			63.52	57.94
LM ascent stage deorbit cutoff	149:29:36.9	57.42	5,176.8	82.1	196.2	57.59	-63.15
CSM orbit plane change ignition	159:04:45.47	58.70	5,353.2			64.23	56.58
CSM orbit plane change cutoff	159:05:04.72	58.90	5,353.0	19.25	381.8	64.66	56.81

Apollo 12 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	172:27:16.81	63.6	5,322.9			-0.202	-115.73
Transearth injection cutoff	172:29:27.13	66.0	8,350.4	130.32	3,042.0	2.718	-116.45
Midcourse correction ignition	188:27:15.8	180,031.2	3,035.6			-78.444	91.35
Midcourse correction cutoff	188:27:20.2	180,029.0	3,036.0	4.4	2.0	-78.404	91.36
Midcourse correction ignition	241:21:59.7	25,059.0	12,082.9			-68.547	96.00
Midcourse correction cutoff	241:22:05.4	25,048.3	12,084.7	5.7	2.4	-68.547	96.01
CM/SM separation	244:07:20.1	1,949.5	29,029.1			-36.454	98.17

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

APOLLO 13

The Seventh Mission:
The Third Lunar Landing Attempt
11 April–17 April 1970

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 13 Spacecraft History

Event	Date
Individual and combined CM and SM systems test completed at factory.	16 Mar 1969
Integrated CM and SM systems test completed at factory.	08 Apr 1969
LM #7 final engineering evaluation acceptance test at factory.	18 May 1969
LM #7 integrated test at factory.	18 May 1969
Saturn S-IVB stage #508 delivered to KSC.	13 Jun 1969
Saturn S-IC stage #8 delivered to KSC.	16 Jun 1969
Saturn S-IC stage #8 erected on MLP #3.	18 Jun 1969
LM ascent stage #7 ready to ship from factory to KSC.	24 Jun 1969
CM #109 and SM #109 ready to ship from factory to KSC.	25 Jun 1969
LM descent stage #7 ready to ship from factory to KSC.	25 Jun 1969
CM #109 and SM #109 delivered to KSC.	26 Jun 1969
LM ascent stage #7 delivered to KSC.	27 Jun 1969
LM descent stage #7 delivered to KSC.	28 Jun 1969
Saturn S-II stage #8 delivered to KSC.	29 Jun 1969
CM #109 and SM #109 mated.	30 Jun 1969
CSM #109 combined systems test completed.	07 Jul 1969
Saturn V instrument unit #508 delivered to KSC.	07 Jul 1969
LM ascent stage #7 and descent stage #7 mated.	15 Jul 1969
Saturn S-II stage #8 erected.	17 Jul 1969
Spacecraft/LM adapter #16 delivered to KSC.	18 Jul 1969
LM #7 combined systems test completed.	22 Jul 1969
Saturn S-IVB stage #508 erected.	31 Jul 1969
Saturn V instrument unit #508 erected.	01 Aug 1969
Launch vehicle electrical systems test completed.	29 Aug 1969
CSM #109 altitude tests completed.	12 Sep 1969
LM #7 altitude tests completed.	20 Sep 1969
Launch vehicle propellant dispersion/malfunction overall test completed.	21 Oct 1969
Launch vehicle service arm overall test completed.	04 Dec 1969
CSM #109 moved to VAB	09 Dec 1969
Spacecraft erected.	10 Dec 1969
Space vehicle and MLP #3 transferred to launch complex 39A.	15 Dec 1969
CSM #109 integrated systems test completed.	05 Jan 1970
LM #7 combined systems test completed.	05 Jan 1970
CSM #109 electrically mated to launch vehicle.	18 Jan 1970
Space vehicle overall test #1 (plugs in) completed.	20 Jan 1970
LM #6 flight readiness test completed.	24 Feb 1970
Space vehicle flight readiness test completed.	26 Feb 1970
Saturn S-IC stage #8 RP-1 fuel loading completed.	16 Mar 1970
Space vehicle countdown demonstration test (wet) completed.	25 Mar 1970
Space vehicle countdown demonstration test (dry) completed.	26 Mar 1970

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 13 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.61	0.032	0.000	0.9	1,340.7		28.4470	-80.6041	0.04	90.00
Mach 1 achieved	000:01:08.4	4.394	1.310	1,095.2	2,087.5		28.4533	-80.5804	27.34	85.14
Maximum dynamic pressure	000:01:21.3	6.727	2.829	1,550.6	2,566.2		28.4608	-80.5529	28.98	82.96
S-IC center engine cutoff*	000:02:15.18	23.464	24.266	5,162.8	6,328.2	141.9	28.5677	-80.1654	23.612	76.609
S-IC outboard engine cutoff	000:02:43.6	36.392	50.991	7,787.3	9,002.5	170.3	28.6989	-79.6810	19.480	75.696
S-IC/S-II separation*	000:02:44.3	36.739	51.815	7,820.8	9,036.3		28.7029	-79.6660	19.383	75.693
S-II center engine #5 cutoff	000:05:30.64	86.183	298.100	11,566.6	12,859.6	164.64	29.8167	-75.1433	4.158	76.956
S-II to complete CECO*	000:07:42.6	97.450	580.109	15,583.8	16,904.3	132.00	30.8785	-69.8409	0.77	79.40
S-II outboard engine cutoff	000:09:52.64	102.112	964.578	21,288.0	22,610.8	426.64	31.9133	-62.4374	0.657	83.348
S-II/S-IVB separation*	000:09:53.50	102.150	967.505	21,301.6	22,624.5		31.9193	-62.3805	0.650	83.380
S-IVB 1st burn cutoff	000:12:29.83	103.469	1,533.571	24,236.4	25,560.4	152.93	32.5241	-51.2552	0.004	89.713
Earth orbit insertion	000:12:39.83	103.472	1,572.300	24,242.1	25,566.1		32.5249	-50.4902	0.005	90.148

*Only the commanded time is available for this event.

Apollo 13 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:12:39.83	25,566.1			100.3	99.3	88.19	32.547
S-IVB 2nd burn ignition	002:35:46.30	25,573.2						
S-IVB 2nd burn cutoff	002:41:37.15	35,562.6	350.85	10,039.0				31.818

Apollo 13 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	002:41:47.15	182.445	35,538.4			7.635	59.318
CSM separated from S-IVB	003:06:38.9	3,778.582	25,029.2			45.030	72.315
CSM docked with LM/S-IVB	003:19:08.8	5,934.90	21,881.4			51.507	79.351
CSM/LM ejected from S-IVB	004:01:00.8	12,455.83	16,619.0			61.092	91.491
Midcourse correction ignition (CM SPS)	030:40:49.65	121,381.93	4,682.5			77.464	112.843
Midcourse correction cutoff	030:40:53.14	121,385.43	4,685.6	3.49	23.2	77.743	112.751
Midcourse correction ignition (LM DPS)	061:29:43.49	188,371.38	3,065.8			79.364	115.464
Midcourse correction cutoff	061:30:17.72	188,393.19	3,093.2	34.23	37.8	79.934	116.54

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 13 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition (LM DPS)	079:27:38.95	5,465.26	4,547.7			72.645	-116.308
Transearth injection cutoff	079:32:02.77	5,658.68	5,020.2	263.82	860.5	64.784	-117.886
Midcourse correction ignition (LM DPS)	105:18:28.0	152,224.32	4,457.8			-79.673	114.134
Midcourse correction cutoff	105:18:42.0	152,215.52	4,456.6	14.0	7.8	-79.765	114.242
Midcourse correction ignition (LM RCS)	137:39:51.5	37,808.58	10,109.1			-72.369	118.663
Midcourse correction cutoff	137:40:13.0	37,776.05	10,114.6	21.5	3.2	-72.373	118.660
SM separation	138:01:48.0	35,694.93	10,405.9			-71.941	118.824
LM jettisoned	141:30:00.2	11,257.48	17,465.9			-60.548	120.621

APOLLO 14

The Eighth Mission
The Third Lunar Landing
31 January–09 February 1971

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 14 Spacecraft History

Event	Date
Individual and combined CM and SM systems test completed at factory.	02 Apr 1969
Integrated CM and SM systems test completed at factory.	07 May 1969
LM #8 final engineering evaluation acceptance test at factory.	25 Aug 1969
LM #8 integrated test at factory.	25 Aug 1969
LM ascent stage #8 ready to ship from factory to KSC.	08 Nov 1969
LM descent stage #8 ready to ship from factory to KSC.	13 Nov 1969
CM #110 and SM #110 ready to ship from factory to KSC.	17 Nov 1969
CM #110 and SM #110 delivered to KSC.	19 Nov 1969
CM #110 and SM #110 mated.	24 Nov 1969
LM ascent stage #8 delivered to KSC.	24 Nov 1969
LM descent stage #8 delivered to KSC.	24 Nov 1969
Saturn S-IC stage #9 delivered to KSC.	11 Jan 1970
Saturn S-IC stage #9 erected on MLP #2	14 Jan 1970
LM ascent stage #8 and descent stage #8 mated.	20 Jan 1970
Saturn S-IVB stage #509 delivered to KSC.	20 Jan 1970
Saturn S-II stage #9 delivered to KSC.	21 Jan 1970
LM #8 combined systems test completed.	22 Jan 1970
CSM #110 combined systems test completed.	02 Feb 1970
Spacecraft/LM adapter #17 delivered to KSC.	31 Mar 1970
Saturn V instrument unit #509 delivered to KSC.	06 May 1970
Saturn S-II stage #9 erected.	12 May 1970
Saturn S-IVB stage #509 erected.	13 May 1970
Saturn V instrument unit #509 erected.	14 May 1970
Launch vehicle electrical systems test completed.	04 Jun 1970
LM #8 altitude tests completed.	22 Jun 1970
Launch vehicle propellant dispersion/malfunction overall test completed.	07 Jul 1970
CSM #110 altitude tests completed.	01 Sep 1970
Launch vehicle service arm overall test completed.	21 Oct 1970
CSM #110 moved to VAB	04 Nov 1970
Spacecraft erected.	04 Nov 1970
Space vehicle and MLP #2 transferred to launch complex 39A.	09 Nov 1970
LM #8 combined systems test completed.	16 Nov 1970
CSM #110 integrated systems test completed.	18 Nov 1970
CSM #110 electrically mated to launch vehicle.	13 Dec 1970
LM #7 flight readiness test completed.	14 Dec 1970
Space vehicle overall test #1 (plugs in) completed.	14 Dec 1970
Space vehicle flight readiness test completed.	19 Dec 1970
Saturn S-IC stage #9 RP-1 fuel loading completed.	08 Jan 1971
Space vehicle countdown demonstration test (wet) completed.	18 Jan 1971
Space vehicle countdown demonstration test (dry) completed.	19 Jan 1971

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 14 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.57	0.060	0.000	1.1	1,340.7		28.4470	-80.6041	0.05	90.00
Mach 1 achieved	000:01:08.0	4.337	1.379	1,077.0	2,082.4		28.4521	-80.5787	26.80	86.06
Maximum dynamic pressure	000:01:21.0	6.649	2.886	1,524.6	2,540.5		28.4580	-80.5509	28.77	84.61
S-IC center engine cutoff	000:02:15.14	23.202	24.169	5,103.0	6,283.6	141.6	28.5441	-80.1598	23.554	79.228
S-IC outboard engine cutoff	000:02:44.10	36.317	51.132	7,741.7	8,972.5	170.6	28.6516	-79.6634	19.584	78.468
S-IC/S-II separation	000:02:44.8	36.663	51.947	7,773.0	9,004.8		28.6548	-79.6484	19.489	78.468
S-II center engine cutoff	000:07:43.09	98.091	594.709	17,212.7	18,554.4	296.59	30.3347	-69.4425	0.829	82.809
S-II outboard engine cutoff	000:09:19.05	101.556	890.920	21,562.5	22,905.8	392.55	30.8611	-63.7444	0.621	85.784
S-II/S-IVB separation	000:09:20.00	101.596	894.194	21,573.8	22,917.2		30.8654	-63.6810	0.612	85.818
S-IVB 1st burn cutoff	000:11:40.56	103.091	1,406.287	24,215.6	25,559.9	137.16	31.0978	-53.7349	-0.004	91.245
Earth orbit insertion	000:11:50.56	103.086	1,444.989	24,221.6	25,565.8		31.0806	-52.9826	-0.003	91.656

Apollo 14 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:11:50.56	25,565.8			100.1	98.9	88.18	31.120
S-IVB 2nd burn ignition	002:28:32.40	25,579.0						
S-IVB 2nd burn cutoff	002:34:23.24	35,535.5	350.84	10,366.5				30.835

Apollo 14 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	002:34:33.24	179.544	35,511.6			7.480	65.583
CSM separated from S-IVB	003:02:29.4	4,289.341	24,102.3			46.810	65.369
CSM docked with LM/S-IVB	004:56:56.7	20,603.4	13,204.1			66.31	84.77
CSM/LM ejection ignition	005:47:14.4	26,299.6	11,723.5			68.54	87.76
CSM/LM ejection cutoff	005:47:21.3			6.9	0.8		
Midcourse correction ignition	030:36:07.91	118,515	4,437.9			76.47	101.98
Midcourse correction cutoff	030:36:18.10	118,522.1	4,367.2	10.19	71.1	76.95	102.23
Midcourse correction ignition	076:58:11.98	11,900.3	3,711.4			-80.1	295.57
Midcourse correction cutoff	076:58:12.63	11,899.7	3,713.1	0.65	3.5	-80.1	295.65

Apollo 14 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	081:56:40.70	87.4	8,061.4				
Lunar orbit insertion cutoff	082:02:51.54	64.2	5,458.5	370.84	3,022.4	169.0	58.1
Descent orbit insertion ignition	086:10:52.97	59.2	5,484.8				
Descent orbit insertion cutoff	086:11:13.78	59	5,279.5	20.81	205.7	58.8	9.1
CSM/LM undocking/separation ignition	103:47:41.6	30.5	5,435.8				
CSM/LM undocking/separation cutoff	103:47:44.3			2.7	0.8	60.2	7.8
CSM orbit circularization ignition	105:11:46.11	60.5	5,271.3				
CSM orbit circularization cutoff	105:11:50.13	60.3	5,342.1	4.02	77.2	63.9	56.0
LM powered descent initiation	108:02:26.52	7.8	5,565.6				
LM powered descent cutoff	108:15:11.13			764.61			
CSM plane change ignition	117:29:33.17	62.1	5,333.1				
CSM plane change cutoff	117:29:51.67	62.1	5,333.3	18.50	370.5	62.1	57.7
LM lunar liftoff ignition	141:45:40						
Lunar ascent orbit cutoff	141:52:52.1			432.1	6,066.1	51.7	8.5
LM vernier adjustment ignition	141:56:49.4	11.1	5,548.5				
LM vernier adjustment cutoff	141:57:01.5			12.1	10.3	51.2	8.4
LM terminal phase initiation ignition	142:30:51.1	44.8	5,396.6				
LM terminal phase initiation cutoff	142:30:54.7			3.6	88.5	60.1	46.0
LM terminal phase finalize ignition	143:13:29.1	58.8	5,365.5				
LM terminal phase finalize cutoff	143:13:55.8			26.7	32	61.5	58.2
CSM/LM docked	143:32:50.5	58.6	5,353.5				
LM ascent stage jettisoned	145:44:58.0	59.9	5,344.6				
CSM/LM final separation ignition	145:49:42.5	60.6	5,341.7				
CSM/LM final separation cutoff	145:49:58.3			15.8	3.4	63.4	56.8
LM ascent stage deorbit ignition	147:14:16.9	57.2	5,358.7				
LM ascent stage fuel depletion	147:15:33.1	57.2	5,177	76.2	186.1	56.7	-59.8

Apollo 14 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	148:36:02.30	60.9	5,340.6			-0.17	260.81
Transearth injection cutoff	148:38:31.53	66.5	8,505	149.23	3,460.6	5.29	266.89
Midcourse correction ignition	165:34:56.69	176,713.8	3,593.2			-79.61	124.88
Midcourse correction cutoff	165:34:59.69			3.00	0.5		
CM/SM separation	215:32:42.2	1,965	29,050.8			-36.62	117.11

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

APOLLO 15

The Ninth Mission:
The Fourth Lunar Landing
26 July-7 August 1971

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 15 Spacecraft History

Event	Date
Individual and combined CM and SM systems test completed at factory.	05 Nov 1969
Saturn S-II stage #10 delivered to KSC.	18 May 1970
Saturn S-IVB stage #510 delivered to KSC.	13 Jun 1970
Saturn V instrument unit #510 delivered to KSC.	26 Jun 1970
Saturn S-IC stage #10 delivered to KSC.	06 Jul 1970
Saturn S-IC stage #10 erected on MLP #3.	08 Jul 1970
Spacecraft/LM adapter #19 delivered to KSC.	08 Jul 1970
Saturn S-II stage #10 erected.	15 Sep 1970
Saturn S-IVB stage #510 erected.	16 Sep 1970
Saturn V instrument unit #510 erected.	17 Sep 1970
LM #10 final engineering evaluation acceptance test at factory.	21 Sep 1970
LM #10 integrated test at factory.	21 Sep 1970
LM #10 delivered to KSC and launch electrical systems tests completed.	17 Nov 1970
Launch vehicle electrical systems tests completed.	17 Nov 1970
Integrated CM and SM systems test completed at factory.	24 Nov 1970
CM #112 and SM #112 ready to ship from factory to KSC.	11 Jan 1971
CM #112 and SM #112 delivered to KSC.	14 Jan 1971
CM #112 and SM #112 mated.	18 Jan 1971
LM ascent stage #10 and descent stage #10 mated.	09 Feb 1971
LM #10 combined systems test completed.	12 Feb 1971
CSM #112 combined systems test completed.	08 Mar 1971
LRV #1 delivered to KSC.	15 Mar 1971
LM #10 altitude tests completed.	06 Apr 1971
CSM #112 altitude tests completed.	09 Apr 1971
Launch vehicle propellant dispersion/malfunction overall test completed.	15 Apr 1971
Launch vehicle service arm overall test completed.	27 Apr 1971
LRV #1 installed.	28 Apr 1971
CSM #112 moved to VAB	08 May 1971
Spacecraft erected.	08 May 1971
Space vehicle and MLP #3 transferred to launch complex 39A.	11 May 1971
LM #10 combined systems test completed.	17 May 1971
CSM #112 integrated systems test completed.	18 May 1971
CSM #112 electrically mated to launch vehicle.	07 Jun 1971
Space vehicle overall test #1 (plugs in) completed.	09 Jun 1971
LM #8 flight readiness test completed.	10 Jun 1971
Space vehicle flight readiness test completed.	22 Jun 1971
Saturn S-IC stage #10 RP-1 fuel loading completed.	06 Jul 1971
Space vehicle countdown demonstration test (wet) completed.	13 Jul 1971
Space vehicle countdown demonstration test (dry) completed.	14 Jul 1971

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 15 Ascent Phase

Event	GET (hhh:mm:ss)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.58	0.000	1.5	1,340.7		28.4470	-80.6041	0.07	90.00
Mach 1 achieved	000:01:05.0	1.004	1,052.0	2,028.1		28.4497	-80.5854	27.86	87.36
Maximum dynamic pressure	000:01:22.0	2.970	1,661.1	2,681.3		28.4555	-80.5847	29.80	85.77
S-IC center engine cutoff*	000:02:15.96	25.987	5,518.4	6,708.5	142.46	28.5203	-80.1190	24.217	82.494
S-IC outboard engine cutoff	000:02:39.56	48.610	7,811.3	9,043.3	166.06	28.5824	-79.6961	21.266	82.129
S-IC/S-II separation*	000:02:41.2	596.012	7,827.6	9,062.2		28.5876	-79.6605	21.021	82.144
S-II outboard engine cutoff	000:09:09.06	874.532	21,588.4	22,949.6	386.06	29.6810	-63.9910	0.059	89.863
S-II/S-IVB separation*	000:09:10.1	878.126	21,601.2	22,962.5		29.6811	-63.9221	0.047	89.900

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S-IVB 1st burn cutoff	000:11:34.67	1,406.808	24,236.4	25,596.7	141.47	29.2688	-53.8183	0.013	95.149
Earth orbit insertion	000:11:44.67	1,445.652	24,242.4	25,602.6		29.2052	-53.0807	0.015	95.531

*Only the commanded time is available for this event.

Apollo 15 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:11:44.67	25,602.6			91.5	89.6	87.84	29.679
S-IVB 2nd burn ignition	002:50:02.90	25,597.1						
S-IVB 2nd burn cutoff	002:55:53.61	35,603.0	350.71	10,414.7				

Apollo 15 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	002:56:03.61	173.679	35,579.1			7.430	73.173
CSM separated from S-IVB	003:22:27.2	4,028.139	24,586.6			46.015	112.493
CSM docked with LM/S-IVB	003:33:49.5	5,985.4	21,811.0			51.66	115.86
CSM/LM ejected from S-IVB	004:18:01.2	12,826.9	16,402.2			61.45	119.20
Midcourse correction ignition	028:40:22.0	114,783.2	4,849.8			77.22	116.83
Midcourse correction cutoff	028:40:22.8	114,784.0	4,845.6	0.8	5.3	77.18	116.76
Midcourse correction ignition	073:31:14.81	12,618.4	3,963.1			-81.08	-139.68
Midcourse correction cutoff	073:31:15.72	12,617.7	3,966.8	0.91	5.4	-81.10	-140.00

Apollo 15 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	078:31:46.70	86.7	8,188.6				
Lunar orbit insertion cutoff	078:38:25.06	74.1	5,407.5	398.36	3,000.1	170.1	57.7
Descent orbit insertion ignition	082:39:49.09	55.3	5,491.7				
Descent orbit insertion cutoff	082:40:13.62	54.9	5,285	24.53	213.9	58.5	9.6
Descent orbit trim ignition	095:56:44.70	56.4	5,276.9				
Descent orbit trim cutoff	095:57:15.10	50.1	5,314.8	30.40	3.2	60.3	8.8
LM undocking and separation	100:39:16.2	7.4	5,553.6				
CSM orbit circularization ignition	101:38:58.98	57.1	5,276.5				
CSM orbit circularization cutoff	101:39:02.65	55.8	5,352.3	3.67	68.3	65.2	54.8
LM powered descent initiation	104:30:09.4	5.8	5,560.2				
LM powered descent cutoff	104:42:28.6			739.2	6813		
CSM plane change ignition	165:11:32.74	61.8	5,318.1				
CSM plane change cutoff	165:11:51.05	62	5,318.8	18.31	330.6	64.5	53.6
LM lunar liftoff ignition	171:37:23.2	54.8	5,357.1				
LM ascent orbit cutoff	171:44:34.2			431.0	6,059	42.5	9.0
LM terminal phase initiation ignition	172:29:40.0	34.2	5,368.8				
LM terminal phase initiation cutoff	172:29:42.6			2.6	72.7	64.4	38.7
CSM/LM docked	173:36:25.5	57	5,345.8				
LM ascent stage jettisoned	179:30:01.4	57.5	5,342.1				
CSM separation from LM	179:50				2		
LM ascent stage deorbit ignition	181:04:19.8	61.5	5,318.9				
LM ascent stage deorbit cutoff	181:05:42.8	61.8	5,196.0	83.0	200.3		
CSM orbit shaping maneuver ignition	221:20:48.02	53.6	5,362.9				
CSM orbit shaping maneuver cutoff	221:20:51.44	53.7	5,379.2	3.42	66.4	76.0	54.3
Subsatellite deployed	222:39:29.1	62.6	5,331.6			76.3	55.1

Apollo 15 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	223:48:45.84	67.6	5,305.9			0.52	-128.90
Transearth injection cutoff	223:51:06.74	71.8	8,272.4	140.90	3,046.8	4.43	-129.08
Midcourse correction ignition	291:56:49.91	25,190.3	11,994.6			-68.47	103.11
Midcourse correction cutoff	291:57:12.21	25,149.3	12,002.4	22.30	5.6	-68.49	103.09
CM/SM separation	294:43:55.2	1,951.8	29,001.7			-36.44	56.65

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

APOLLO 16

The Tenth Mission
The Fifth Lunar Landing
16 April–27 April 1972

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 16 Spacecraft History

Event	Date
Saturn S-IVB stage #511 delivered to KSC.	01 Jul 1970
Spacecraft/LM adapter #20 delivered to KSC.	17 Aug 1970
Saturn V instrument unit #511 delivered to KSC.	29 Sep 1970
Saturn S-II stage #11 delivered to KSC.	30 Sep 1970
Individual and combined CM and SM systems test completed at factory.	03 Dec 1970
LM #11 final engineering evaluation acceptance test at factory.	24 Feb 1971
Integrated CM and SM systems test completed at factory.	17 Mar 1971
LM descent stage #11 ready to ship from factory to KSC.	01 May 1971
LM descent stage #11 delivered to KSC.	05 May 1971
LM ascent stage #11 ready to ship from factory to KSC.	07 May 1971
LM ascent stage #11 delivered to KSC.	14 May 1971
CM #113 and SM #113 ready to ship from factory to KSC.	26 Jul 1971
CM #113 and SM #113 delivered to KSC.	29 Jul 1971
CM #113 and SM #113 mated.	02 Aug 1971
LRV #2 delivered to KSC.	01 Sep 1971
CSM #113 combined systems test completed.	13 Sep 1971
Saturn S-IC stage #11 delivered to KSC.	17 Sep 1971
Saturn S-IC stage #11 erected on MLP #3	21 Sep 1971
Saturn V instrument unit #511 delivered to KSC.	29 Sep 1971
Saturn S-II stage #11 erected.	01 Oct 1971
Saturn S-IVB stage #511 erected.	05 Oct 1971
Saturn V instrument unit #511 erected.	06 Oct 1971
Launch vehicle electrical systems test completed.	15 Oct 1971
LM #11 altitude tests completed.	19 Oct 1971
CSM #113 altitude tests completed.	21 Oct 1971
Launch vehicle propellant dispersion/malfunction overall test completed.	08 Nov 1971
LRV #2 installed.	16 Nov 1971
Launch vehicle service arm overall test completed.	18 Nov 1971
CSM #113 moved to VAB	07 Dec 1971
Spacecraft erected.	08 Dec 1971
Space vehicle and MLP #3 transferred to launch complex 39A.	13 Dec 1971
CSM #113 integrated systems test completed.	03 Jan 1972
LM #11 combined systems test completed.	04 Jan 1972
Space vehicle and MLP #3 returned to VAB.	27 Jan 1972
Space vehicle and MLP #3 returned to launch complex 39A.	09 Feb 1972
CSM #113 integrated systems test repeated.	14 Feb 1972
CSM #113 electrically mated to launch vehicle.	21 Feb 1972
Space vehicle overall test #1 (plugs in) completed.	23 Feb 1972
LM #9 flight readiness test completed.	24 Feb 1972
Space vehicle flight readiness test completed.	02 Mar 1972
Saturn S-IC stage #11 RP-1 fuel loading completed.	20 Mar 1972
Space vehicle countdown demonstration test (wet) completed.	30 Mar 1972
Space vehicle countdown demonstration test (dry) completed.	31 Mar 1972

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 16 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.59	0.060	0.000	0.0	1,340.7		28.4470	-80.6041	0.05	90.00
Mach 1 achieved	000:01:07.5	4.282	1.358	1,076.4	2,075.5		28.4539	-80.5797	26.79	84.51
Maximum dynamic pressure	000:01:26.0	7.755	3.800	1,759.6	2,785.9		28.4670	-80.5359	29.12	81.64
S-IC center engine cutoff*	000:02:17.85	24.548	26.821	5,488.2	6,658.8	144.55	28.5847	-80.1207	23.105	76.125
S-IC outboard engine cutoff	000:02:41.78	35.698	49.927	7,753.0	8,961.7	168.5	28.7009	-79.7028	19.914	75.328
S-IC/S-II separation*	000:02:43.5	36.560	51.929	7,767.8	8,979.2		28.7109	-79.6666	19.643	75.339
S-II center engine cutoff	000:07:41.77	92.441	592.660	17,039.0	18,357.7	296.57	30.9376	-69.6064	0.116	79.535
S-II outboard engine cutoff	000:09:19.54	93.445	894.079	21,539.3	22,858.7	394.34	31.7737	-63.8100	0.367	82.585
S-II/S-IVB separation*	000:09:20.5	93.468	897.389	21,550.4	22,869.8		31.7812	-63.7457	0.358	82.622
S-IVB 1st burn cutoff	000:11:46.21	93.374	1,430.142	24,280.1	25,600.0	142.61	32.5109	-53.2983	0.001	88.496
Earth orbit insertion	000:11:56.21	93.377	1,469.052	24,286.1	25,605.0		32.5262	-52.5300	0.001	88.932

*Only the commanded time is available for this event.

Apollo 16 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclination (deg)
Earth orbit insertion	000:11:56.21	25,605.1			32.5262	-52.5300	91.3	90.0	87.85	32.542
S-IVB 2nd burn ignition	002:33:36.50	25,598.1			-24.5488	137.4789				
S-IVB 2nd burn cutoff	002:39:18.42	35,590.2	341.92	10,389.6	-12.3781	161.7104				32.511

Apollo 16 Translunar Phase

	GET	Altitude	Space Fixed Velocity	Event Duration	Velocity Change	Space Fixed Flight Path Angle	Space Fixed Heading Angle

Event	(hhh:mm:ss)	(n mi)	(ft/sec)	(sec)	(ft/sec)	(deg)	(E of N)
Translunar injection	002:39:28.42	171.243	35,566.1			7.461	59.524
CSM separated from S-IVB	003:04:59.0	3,870.361	24,824.8			45.397	69.807
CSM/LM ejected from S-IVB	003:59:15.1	12,492.7	16,533.5			61.07	88.39
Midcourse correction ignition	030:39:00.66	119,343.8	4,514.8			76.86	111.56
Midcourse correction cutoff	030:39:02.67	119,345.3	4,508.1	2.01	12.5	76.72	111.50

Apollo 16 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Geodetic Latitude (deg N)	Longitude (deg E)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	074:28:27.87	93.9	8,105.4			8.15	-166.63		
Lunar orbit insertion cutoff	074:34:42.77	75.3	5,399.2	374.90	2,802	7.12	169.32	170.3	58.1
Descent orbit insertion ignition	078:33:45.04	58.5	5,486.3			8.58	136.02		
Descent orbit insertion cutoff	078:34:09.39	58.4	5,281.9	24.35	209.5	8.58	-137.27	58.5	10.9
LM undocking and separation	096:13:31	33.8	5,417.2			2.37	121.92		
CSM orbit circularization ignition	103:21:43.08	59.2	5,277.8			9.22	-151.98		
CSM orbit circularization cutoff	103:21:47.74	59.1	5,348.7	4.66	81.6	9.23	-151.95	68.0	53.1
LM powered descent initiation	104:17:25	10.944	5,548.8			-8.67	32.73		
LM powered descent cutoff	104:29:36			731	6,703				
CSM plane change ignition	169:05:52.14	58.6	5,349.8			5.60	108.83		
CSM plane change cutoff	169:05:59.28	58.6	5,349.9	7.14	124	5.57	108.50	64.6	55.0
LM lunar liftoff ignition	175:31:47.9								
LM lunar ascent orbit cutoff	175:38:55.7	9.9	5,523.3	427.8	6,054.2	-9.77	5.43	40.2	7.9
LM vernier adjustment	175:42:18	11.2	5,515.2			-10.67	-5.83		
LM terminal phase initiation ignition	176:26:05	40.2	5,351.6			6.88	-147.37		
LM terminal phase initiation cutoff	176:26:07.5			2.5	78.0				
LM terminal phase finalize	177:08:42								40.1
CSM/LM docked	177:41:18	65.6	5,313.7			-10.53	-55.65		
LM ascent stage jettisoned	195:00:12	59.2	5,347.9						
CSM separation maneuver	195:03:13				2.0	-0.02	-115.98		
Subsatellite deployed	196:02:09	58.4	5,349.4			1.13	70.47	66	52

Apollo 16 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	200:21:33.07	52.2	5,383.6			0.15	-85.80
Transearth injection cutoff	200:24:15.36	59.7	8,663.0	162.29	3,370.9	5.12	-82.37
Midcourse correction ignition	214:35:02.8	183,668.0	3,806.8			-75.08	165.08
Midcourse correction cutoff	214:35:25.4	183,664.8	3,807.9	22.6	3.4	-80.35	164.99
Midcourse correction ignition	262:37:20.7	25,312.9	12,256.5			-69.02	157.11
Midcourse correction cutoff	262:37:27.1	25,305.2	12,258.3	6.4	1.4	-69.02	157.10

APOLLO 17

The Eleventh Mission:
The Sixth Lunar Landing
7 December–19 December 1972

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 17 Spacecraft History

Event	Date
Saturn S-II stage #12 delivered to KSC.	27 Oct 1970
Saturn S-IVB stage #512 delivered to KSC.	21 Dec 1970
Individual and combined CM and SM systems test completed at factory.	08 May 1971
LM #12 final engineering evaluation acceptance test at factory.	23 May 1971
LM #12 integrated test at factory.	23 May 1971
LM ascent stage #12 ready to ship from factory to KSC.	14 Jun 1971
LM descent stage #12 ready to ship from factory to KSC.	14 Jun 1971
LM ascent stage #12 delivered to KSC.	16 Jun 1971
LM descent stage #12 delivered to KSC.	17 Jun 1971
Integrated CM and SM systems test completed at factory.	02 Aug 1971
CM #114 and SM #114 ready to ship from factory to KSC.	17 Mar 1972
CM #114 and SM #114 delivered to KSC.	24 Mar 1972
Spacecraft/LM adapter #21 delivered to KSC.	24 Mar 1972
CM #114 and SM #114 mated.	28 Mar 1972
CSM #114 combined systems test completed.	09 May 1972
Saturn S-IC stage #12 delivered to KSC.	11 May 1972
Saturn S-IC stage #12 erected on MLP #3.	15 May 1972
LM ascent stage #12 and descent stage #12 mated.	18 May 1972
Saturn S-II stage #12 erected.	19 May 1972
LRV #3 delivered to KSC.	02 Jun 1972
LM #12 combined systems test completed.	07 Jun 1972
Saturn S-IVB instrument unit #512 delivered to KSC.	07 Jun 1972
CSM #114 altitude tests completed.	19 Jun 1972
Saturn S-IVB instrument unit #512 erected.	20 Jun 1972
Saturn S-IVB stage #512 erected.	23 Jun 1972
Launch vehicle electrical systems test completed.	12 Jul 1972
LM #12 altitude tests completed.	25 Jul 1972
Launch vehicle propellant dispersion/malfunction overall test completed.	01 Aug 1972
Launch vehicle service arm overall test completed.	11 Aug 1972
LRV #3 installed.	13 Aug 1972
CSM #114 moved to VAB	22 Aug 1972
Spacecraft erected.	23 Aug 1972
Spacecraft moved to VAB.	24 Aug 1972
Space vehicle and MLP #3 transferred to launch complex 39A.	28 Aug 1972
LM #12 combined systems test completed.	06 Sep 1972
CSM #114 integrated systems test completed.	11 Sep 1972
LM #10 flight readiness test completed.	04 Oct 1972
CSM #114 electrically mated to launch vehicle.	11 Oct 1972
Space vehicle overall test #1 (plugs in) completed.	12 Oct 1972
Space vehicle overall test completed.	17 Oct 1972
Space vehicle flight readiness test completed.	20 Oct 1972
Saturn S-IC stage #12 RP-1 loading completed.	10 Nov 1972
Space vehicle countdown demonstration test (wet) completed.	20 Nov 1972
Space vehicle countdown demonstration test (dry) completed.	21 Nov 1972

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Apollo 17 Ascent Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Range (n mi)	Earth Fixed Velocity (ft/sec)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Geocentric Latitude (deg N)	Longitude (deg E)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Liftoff	000:00:00.63	0.060	0.000	1.1	1,340.6		28.4470	-80.6041	0.05	90.00
Mach 1 achieved	000:01:07.5	4.315	1.265	1,076.7	2,085.8		28.4465	-80.5082	26.91	90.29
Maximum dynamic pressure	000:01:22.5	6.992	3.071	1,611.1	2,650.5		28.4457	-80.5460	28.89	91.04
S-IC center engine cutoff*	000:02:19.30	25.388	27.795	5,646.8	6,862.7	146.2	28.4329	-80.0781	23.199	91.355
S-IC outboard engine cutoff	000:02:41.20	35.900	49.145	7,757.4	9,012.1	168.1	28.4211	-79.6741	20.4285	91.718
S-IC/S-II separation*	000:02:42.9	36.776	51.112	7,778.4	9,036.1		28.4200	-79.6369	20.151	91.741
S-II center engine cutoff	000:07:41.21	93.420	591.254	17,064.6	18,439.6	296.61	27.5754	-69.4919	-0.058	97.647
S-II outboard engine cutoff	000:09:19.66	93.182	895.010	21,559.1	22,933.5	395.06	26.7251	-63.8908	0.254	100.395
S-II/S-IVB separation*	000:09:20.6	93.195	898.234	21,567.7	22,942.1		26.7147	-63.8314	0.244	100.424
S-IVB 1st burn cutoff	000:11:42.65	92.082	1,417.476	24,225.0	25,598.0	138.85	24.7139	-54.4952	0.00118	104.718
Earth orbit insertion	000:11:52.65	92.057	1,456.314	24,230.9	25,603.9		24.5384	-53.8107	0.0003	105.021

*Only the commanded time is available for this event.

Apollo 17 Earth Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apogee (n mi)	Perigee (n mi)	Period (mins)	Inclin-ation (deg)
Earth orbit insertion	000:11:52.65	92.057	25,603.9			90.3	90.0	87.83	28.526
S-IVB 2nd burn ignition	003:12:36.60	96.417	22,589.4						
S-IVB 2nd burn cutoff	003:18:27.64	162.127	35,579.5	351.04	10,376				28.466

Apollo 17 Translunar Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Translunar injection	003:18:37.64	169.401	35,555.3			7.379	118.110
CSM separated from S-IVB	003:42:27.6	3,566.842	25,344.9			44.177	102.769
CSM/LM ejected from S-IVB	004:45:02.3	13,393.6	16,012.8			61.80	83.485
Midcourse correction ignition	035:29:59.91	128,217.7	4,058.1			76.40	66.71
Midcourse correction cutoff	035:30:01.64	128,246.9	4,066.8	1.7	10.5	76.48	66.84

Apollo 17 Lunar Orbit Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Apolune (n mi)	Perilune (n mi)
Lunar orbit insertion ignition	086:14:22.60	76.8	8,110.2				
Lunar orbit insertion cutoff	086:20:55.76	51.2	5,512.1	393.16	2,988	170.0	52.6
1st descent orbit insertion ignition	090:31:37.43	51.1	5,512.7				
1st descent orbit insertion cutoff	090:31:59.70	50.9	5,322.1	22.27	197	59.0	14.5
CSM/LM separation initiated	107:47:56	47.2	5,342.8				
CSM/LM separation cutoff	107:47:59.4			3.4	1	61.5	11.5
CSM orbit circularization ignition	109:17:28.92	58.6	5,279.9				
CSM orbit circularization cutoff	109:17:32.72	58.8	5,349.9	3.80	70.5	70	54
LM 2nd descent orbit insertion ignition	109:22:42	59.6	5,274.5				
LM 2nd descent orbit insertion cutoff	109:23:03.5	59.6	5,267.0	21.5	7.5	59.6	6.2
LM powered descent initiation	110:09:53	8.7	5,550.3				
LM powered descent cutoff	110:21:58			725	6,698		
CSM orbital trim ignition	178:54:05.45	64.9	5,315.1				
CSM orbital trim cutoff	178:54:42.95			37.50	9.2	67.3	62.5
CSM plane change ignition.	179:53:53.83						
CSM plane change cutoff	179:54:13.88	60.5	5,341.1	20.05	366	62.8	62.5
LM lunar liftoff ignition	185:21:37						
LM ascent orbit cutoff	185:28:58	8	5,542.3	441	6,075.7	48.5	9.1
LM vernier adjustment initiated	185:32:12	9.4	5,534.7				
LM vernier adjustment cutoff	185:32:22			10	10.0	48.5	9.4
LM terminal phase initiation ignition	186:15:58	44.6	5,333.3				
LM terminal phase initiation cutoff	186:16:01.2			3.2	53.8	64.7	48.5
CSM/LM docked	187:37:15	60.6	5,341.7				
LM ascent stage jettisoned	191:18:31	60.6	5,343.4				
CSM separation ignition.	191:23:31						
CSM separation cutoff	191:23:43			12	2.0	63.9	61.2
LM ascent stage deorbit ignition	192:58:14	60.5	5,343.7				
LM ascent stage deorbit cutoff	193:00:10	58.9	5,130.1	116	286.0		

Apollo 17 Transearth Phase

Event	GET (hhh:mm:ss)	Altitude (n mi)	Space Fixed Velocity (ft/sec)	Event Duration (sec)	Velocity Change (ft/sec)	Space Fixed Flight Path Angle (deg)	Space Fixed Heading Angle (E of N)
Transearth injection ignition	234:02:09.18	62.1	5,337.1			-0.18	257.32
Transearth injection cutoff	234:04:32.87	63.1	8,374.3	143.69	3,046.3	2.46	259.47
Midcourse correction ignition	298:38:01	25,016.3	12,021.1			-68.43	34.63
Midcourse correction cutoff	298:38:10	24,999.7	12,025.8	9	2.1	-68.42	34.63

ALL MISSION
Statistical Tables

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

General Background[6]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Mission Information											
Mission Type	C	C prime	D	F	G	H-1	H-2	H-3	J-1	J-2	J-3
Purpose	CSM piloted flight demonstration in Earth orbit.	CSM piloted flight demonstration in lunar orbit.	Lunar module piloted flight demonstration in Earth orbit.	Lunar module piloted flight demonstration in lunar orbit.	Piloted lunar landing demonstration.	Precision piloted lunar landing demonstration and systematic lunar exploration.	Precision piloted lunar landing demonstration and systematic lunar exploration.	Precision piloted lunar landing demonstration and systematic lunar exploration.	Extensive scientific investigation of Moon on lunar surface and from lunar orbit.	Extensive scientific investigation of Moon on lunar surface and from lunar orbit.	Extensive scientific investigation of Moon on lunar surface and from lunar orbit
Trajectory Type	Earth Orbital	Lunar Orbital	Earth Orbital	Lunar Orbital	Lunar Landing	Lunar Landing	Lunar Landing	Lunar Landing	Lunar Landing	Lunar Landing	Lunar Landing
Payload Description	Block II CSM, adapter, and LES.	Block II CSM, LM test article, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.	Block II CSM, LM, adapter, and LES.
Launch Information											
Launch Sites (Florida)	Cape Kennedy	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center	Kennedy Space Center
Launch Complex	Complex 34	Complex 39A	Complex 39A	Complex 39B	Complex 39A	Complex 39A	Complex 39A	Complex 39A	Complex 39A	Complex 39A	Complex 39A
Geodetic Latitude	28.521963	28.6	28.608422	28.627306	28.60842	28.608422	28.608422	28.608422	28.608422	28.608422	28.608422

6 Compiled from mission reports, launch vehicle reports, and other sources.

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

(°N)	0842 2			2							
Geocentric Latitude (°N)	28.3608	28.4470	28.4470	28.4658	28.4470	28.4470	28.4470	28.4470	28.4470	28.4470	28.4470
Longitude (°E)	-80.561141	-80.604133	-80.604133	-80.620869	-80.60413 3	-80.604133	-80.604133	-80.604133	-80.604133	-80.604133	-80.604133
Range Zero[7]											
KSC Date	11 Oct 1968	21 Dec 1968	03 Mar 1969	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
KSC Time	11:02:45 a.m.	07:51:00 a.m.	11:00:00 a.m.	12:49:00 p.m.	09:32:00 a.m.	11:22:00 a.m.	02:13:00 p.m.	04:03:02 p.m.	09:34:00 a.m.	12:54:00 p.m.	12:33:00 a.m.
KSC Time Zone	EDT	EST	EST	EDT	EDT	EST	EST	EST	EDT	EST	EST
GMT Date	11 Oct 1968	21 Dec 1968	03 Mar 1969	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
GMT Time	15:02:45	12:51:00	16:00:00	16:49:00	13:32:00	16:22:00	19:13:00	21:03:02	13:34:00	17:54:00	05:33:00
Actual GMT Liftoff Time	15:02:45.36	12:51:00.67	16:00:00.67	16:49:00.58	13:32:00.63	16:22:00.68	19:13:00.61	21:03:02.57	13:34:00.58	17:54:00.59	05:33:00.63
Selected Durations (hhh:mm:ss)											
Ascent to Orbit (sec)	626.76	694.98	674.66	713.76	709.33	703.91	759.83	710.56	704.67	716.21	712.65
Earth Orbit	259:42:59	002:44:30.53	240:32:55.5	002:27:26.82	002:38:23.70	002:41:30.03	002:28:07.32	002:22:42.68	002:44:18.94	002:27:32.21	003:06:44.99
Revolutions	163.0	1.5	151.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0
Translunar Coast	---	066:16:21.8	---	073:22:29.5	073:05:34.87	080:38:01.67	---	079:28:18.30	075:42:21.45	071:55:14.35	083:02:18.12
Time on Lunar Surface	---	---	---	---	021:36:21	031:31:12	---	033:30:29	066:54:54	071:02:13	074:59:39
Lunar Orbit3333	---	020:10:13.0	---	061:43:23.6	059:30:25.79	088:58:11.52	---	066:35:39.99	145:12:41.68	125:49:32.59	147:43:37.11
Revolutions	---	10	---	31	30	45	---	34	74	64	75
CSM/LM Undocked	---	---	006:22:50	008:10:05	027:51:00.0	037:42:17.9	---	039:45:08.9	072:57:09.3	081:27:47	079:49:19
Transearth Coast	---	057:23:32.5	---	054:09:40.8	059:36:52.0	071:52:51.96	---	067:09:13.8	071:07:48	065:13:16	067:34:05
CM Earth Entry (sec)	937	869.2	1,003.8	868.5	929.3	845.9	835.3	852.8	778.3	814	801

7 Range Zero was the integral second before liftoff.

Mission Duration	260:09:03	147:00:42.0	241:00:54	192:03:23	195:18:35	244:36:25	142:54:41	216:01:58.1	295:11:53.0	265:51:05	301:51:59

Crew Information - Earth Orbit and Lunar Orbit Missions[8]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 13[9]
Commander	Walter Marty Schirra, Jr.	Frank Frederick Borman, II	James Alton McDivitt	Thomas Patten Stafford	James Arthur Lovell, Jr.
Date of Birth	12 Mar 1923	14 Mar 1928	10 Jun 1929	17 Sep 1930	25 Mar 1928
Place of Birth	Hackensack, NJ	Gary, IN	Chicago, IL	Weatherford, OK	Cleveland, OH
Date of Death	03 May 2007	07 Nov 2023	13 Oct 2022	---	---
Place of Death	La Jolla, CA	Billings, MT	Tucson, AZ	---	---
Age On Launch Date	45	40	39	38	42
Status	Captain	Colonel	Colonel	Colonel	Captain
					USN
Year Selected Astronaut	1959	1962	1962	1962	1962
Prior Space Flights	MA-8, GT-6A	GT-7	GT-4	GT-6A, GT-9A	GT-7, GT-12, Apollo 8
Backup	Thomas Patten Stafford	Neil Alden Armstrong	Charles Conrad, Jr.	Leroy Gordon Cooper, Jr.	John Watts Young
Status	Colonel	Civilian	Commander	Colonel	Commander
	USAF		USN	USAF	USN
Command Module Pilot	Donn Fulton Eisele	James Arthur Lovell, Jr.	David Randolph Scott	John Watts Young	John Leonard Swigert, Jr.
Date of Birth	23 Jun 1930	25 Mar 1928	06 Jun 1932	24 Sep 1930	30 Aug 1931
Place of Birth	Columbus, OH	Cleveland, OH	San Antonio, TX	San Francisco, CA	Denver, CO
Date of Death	01 Dec 1987	---	---	05 Jan 2015	27 Dec 1982
Place of Death	Tokyo, Japan	---	---	Houston, TX	Washington, DC
Age On Launch Date	38	40	36	38	38
Status	Major	Captain	Colonel	Commander	Civilian
	USAF	USN	USAF	USN	---
Year Selected Astronaut	1963	1962	1963	1962	1966
Prior Space Flights	None	GT-7, GT-12	GT-8	GT-3, GT-10	None
Backup	John Watts Young	Edwin Eugene Aldrin, Jr.	Richard Francis Gordon, Jr.	Donn Fulton Eisele	Thomas Kenneth Mattingly, II
Status	Commander	Colonel	Commander	Lt. Colonel	Lt. Commander
	USN	USAF	USN	USAF	USN
Lunar Module Pilot	Ronnie Walter Cunningham	William Alison Anders	Russell Louis Schweickart	Eugene Andrew Cernan	Fred Wallace Haise, Jr.
Date of Birth	16 Mar 1932	17 Oct 1933	25 Oct 1935	14 Mar 1934	14 Nov 1933
Place of Birth	Creston, IA	Hong Kong	Neptune, NJ	Chicago, IL	Biloxi, MS
Date of Death	03 Jan 2023	---	---	16 Jan 2017	---
Place of Death	Houston, TX	---	---	Houston, TX	---
Age On Launch Date	36	35	33	35	36
Status	Civilian	Major	Civilian	Commander	Civilian
	---	USAF	---	USN	---
Year Selected Astronaut	1963	1963	1963	1963	1966
Prior Space Flights	None	None	None	GT-9A	None
Backup	Eugene Andrew Cernan	Fred Wallace Haise, Jr.	Alan LaVern Bean	Edgar Dean Mitchell	Charles Moss Duke, Jr.
Status	Commander	Civilian	Commander	Commander	Major
	USN	NASA	USN	USN	USAF

8 Compiled from press kits and mission reports, and *Who's Who in Space* (Cassutt).

9 A planned lunar landing was aborted; Apollo 13 looped behind the Moon and returned to Earth.

Originally published in "Apollo by the Numbers", NASA SP-2000-4029, Revised February 2024

Crew Information - Lunar Landing Missions[10]

	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Commander	Neil Alden Armstrong	Charles Conrad, Jr.	Alan Bartlett Shepard, Jr.	David Randolph Scott	John Watts Young	Eugene Andrew Cernan
Date of Birth	05 Aug 1930	02 Jun 1930	18 Nov 1923	06 Jun 1932	24 Sep 1930	14 Mar 1934
Place of Birth	Wapakoneta, OH	Philadelphia, PA	East Derry, NH	San Antonio, TX	San Francisco, CA	Chicago, IL
Date of Death	25 Aug 2012	08 Jul 1999	21 Jul 1998	---	05 Jan 2015	16 Jan 2017
Place of Death	Cincinnati, OH	Ojai, CA	Monterey, CA	---	Houston, TX	Houston, TX
Age On Launch Date	38	39	47	39	41	38
Status	Civilian	Commander	Captain	Colonel	Captain	Captain
	---	USN	USN	USAF	USN	USN
Year Selected Astronaut	1962	1962	1959	1963	1962	1963
Prior Space Flights	GT-8	GT-5, GT-11	MR-3	GT-8, Apollo 9	GT-3, GT-10, Apollo 10	GT-9A, Apollo 10
Backup	James Arthur Lovell, Jr.	David Randolph Scott	Eugene Andrew Cernan	Richard Francis Gordon, Jr.	Fred Wallace Haise, Jr.	John Watts Young
Status	Captain	Colonel	Captain	Captain	Civilian	Captain
	USN	USAF	USN	USN	NASA	USN
Command Module Pilot	Michael Collins	Richard Francis Gordon, Jr.	Stuart Allen Roosa	Alfred Merrill Worden	Thomas Kenneth Mattingly, II	Ronald Ellwin Evans
Date of Birth	31 Oct 1930	05 Oct 1929	16 Aug 1933	07 Feb 1932	17 Mar 1936	10 Nov 1933
Place of Birth	Rome, Italy	Seattle, WA	Durango, CO	Jackson, MI	Chicago, IL	St. Francis, KS
Date of Death	28 Apr 2021	06 Nov 2017	12 Dec 1994	18 Mar 2020	---	07 Apr 1990
Place of Death	Naples, FL	San Marcos, CA	Washington, DC	Sugar Land, TX	---	Scottsdale, AZ
Age On Launch Date	38	40	37	39	36	39
Status	Lt. Colonel	Commander	Major	Major	Lt. Commander	Commander
	USAF	USN	USAF	USAF	USN	USN
Year Selected Astronaut	1963	1963	1966	1966	1966	1966
Prior Space Flights	GT-10	GT-11	None	None	None	None
Backup	William Alison Anders	Alfred Merrill Worden	Ronald Ellwin Evans	Vance DeVoe Brand	Stuart Allen Roosa	Stuart Allen Roosa
Status	Lt. Colonel	Major	Commander	Civilian	Lt. Colonel	Lt. Colonel
	USAF	USAF	USN	NASA	USAF	USAF
Lunar Module Pilot	Edwin Eugene Aldrin, Jr.	Alan LaVern Bean	Edgar Dean Mitchell	James Benson Irwin	Charles Moss Duke, Jr.	Harrison Hagan Schmitt
Date of Birth	20 Jan 1930	15 Mar 1932	17 Sep 1930	17 Mar 1930	03 Oct 1935	03 Jul 1935
Place of Birth	Montclair, NJ	Wheeler, TX	Hereford, TX	Pittsburgh, PA	Charlotte, NC	Santa Rita, NM
Date of Death	---	26 May 2018	04 Feb 2016	08 Aug 1991	---	---
Place of Death	---	Houston, TX	West Palm Beach, FL	Glenwood Springs, CO	---	---
Age On Launch Date	39	37	40	41	36	37
Status	Colonel, Sc. D.	Commander	Commander, Sc. D.	Lt. Colonel	Lt. Colonel	Civilian, Ph. D.
	USAF	USN	USN	USAF	USAF	---
Year Selected Astronaut	1963	1963	1966	1966	1966	1965
Prior Space Flights	GT-12	None	None	None	None	None
Backup	Fred Wallace Haise, Jr.	James Benson Irwin	Joe Henry Engle	Harrison Hagan Schmitt	Edgar Dean Mitchell	Charles Moss Duke, Jr.
Status	Civilian	Lt. Colonel	Lt. Colonel	Civilian	Captain	Colonel
	NASA	USAF	USAF	NASA	USN	USAF

10 Compiled from press kits and mission reports, and *Who's Who in Space* (Cassutt).

Apportionment of Training According to Mission Type[11]

Training Category	Missions Before 1st Lunar Landing (Apollo 7 - 10)		Early Lunar Landing Missions (Apollo 11 - 14)		Final Lunar Landing Missions (Apollo 15 - 17)	
	Hours	% of Total	Hours	% of Total	Hours	% of Total
Simulators	11,511	36	15,029	56	11,413	45
Special Purpose	4,023	13	5,379	20	9,246	36
Procedures	7,924	25	2,084	8	1,265	5
Briefings	5,894	18	3.070	11	2,142	9
Spacecraft Tests	2,576	8	1,260	5	1,255	5
Total	31,928	100	26,822	100	25,321	100

Apollo Training Exercises[12]

Exercise	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Lunar Surface Activity Simulations (Sessions)											
Surface Operations	---	---	---	---	20	31	42	43	91	67	47
Operations Before/After EVA	---	---	---	---	10	4	11	18	20	10	20
Total Per Mission	---	---	---	---	30	35	53	61	111	77	67
Geology Field Trips[13]	---	---	---	---	1	4	7	7	12	18	13

11 *Apollo Program Summary Report* (JSC-09423), pages 6-20 to 6-23. Includes participation of Mission Control Center personnel. Numbers in parentheses indicate simulations accomplished by follow-on or support crewmen.

12 Ibid.

13 Field trips lasted from one to seven days.

Integrated Crew/Ground Mission Simulations (Days)											
Command Module Simulator	18	14	10	11	6 (1)	10	13	12 (3)	13 (6)	16 (5)	13 (2)
Lunar Module Simulator	0	0	2	0	4	3	5	5 (2)	5	7 (1)	6
Command Module and Lunar Module Simulators	0	0	8	7	7	12	9	12 (1)	7	10	9
Total Per Mission	18	14	20	18	17 (1)	25	27	29 (6)	25 (6)	33 (6)	28 (2)

Capsule Communicators (CAPCOMs)[14]

Apollo 7
Col. Thomas Patten Stafford, USAF
Lt. Cdr. Ronald Ellwin Evans, USN
Maj. William Reid Pogue, USAF
John Leonard Swigert, Jr.
Cdr. John Watts Young, USN
Cdr. Eugene Andrew Cernan, USN

Apollo 8
Lt. Col. Michael Collins, USAF
Lt. Cdr. Thomas Kenneth Mattingly, II, USN
Maj. Gerald Paul Carr, USMC
Neil Alden Armstrong
Col. Edwin Eugene Aldrin, USAF/Sc. D.
Vance DeVoe Brand
Fred Wallace Haise, Jr.

Apollo 9
Maj. Stuart Allen Roosa, USAF
Lt. Cdr. Ronald Ellwin Evans, USN
Maj. Alfred Merrill Worden, USAF
Cdr. Charles Conrad, Jr., USN
Cdr. Richard Francis Gordon, Jr., USN
Cdr. Alan LaVern Bean, USN

Apollo 10
Maj. Charles Moss Duke, Jr., USAF
Maj. Joe Henry Engle, USAF
Maj. Jack Robert Lousma, USMC
Lt. Cdr. Bruce McCandless, II, USN

Apollo 11
Maj. Charles Moss Duke, Jr., USAF
Lt. Cdr. Ronald Ellwin Evans, USN
Lt. Cdr. Bruce McCandless, II, USN
Capt. James Arthur Lovell, Jr., USN
Lt. Col. William Alison Anders, USAF
Lt. Cdr. Thomas Kenneth Mattingly, II, USN
Fred Wallace Haise, Jr.
Don Leslie Lind, Ph. D.
Owen Kay Garriott, Jr., Ph. D.
Harrison Hagan Schmitt, Ph. D.

Apollo 12
Lt. Col. Gerald Paul Carr, USMC
Edward George Gibson, Ph. D.
Cdr. Paul Joseph Weitz, USN
Don Leslie Lind, Ph. D.
Col. David Randolph Scott, USAF
Maj. Alfred Merrill Worden, USAF
Lt. Col. James Benson Irwin, USAF

Civilian Backup Capcoms
Dickie K. Warren
James O. Rippey
James L. Lewis
Michael R. Wash

Apollo 13
Cdr. Joseph Peter Kerwin, USN/MD/MC
Vance DeVoe Brand
Maj. Jack Robert Lousma, USMC
Cdr. John Watts Young, USN
Lt. Cdr. Thomas Kenneth Mattingly, II, USN

Apollo 14
Maj. Charles Gordon Fullerton, USAF
Lt. Cdr. Bruce McCandless, II, USN
Fred Wallace Haise, Jr.
Lt. Cdr. Ronald Ellwin Evans, USN

Apollo 15
Joseph Percival Allen, IV, Ph. D.
Maj. Charles Gordon Fullerton, USAF
Karl Gordon Henize, Ph. D.
Cdr. Edgar Dean Mitchell, USN/Sc. D.
Robert Alan Ridley Parker, Ph. D.
Harrison Hagan Schmitt, Ph. D.
Capt. Alan Bartlett Shepard, Jr., USN
Capt. Richard Francis Gordon, Jr., USN
Vance DeVoe Brand

Apollo 16
Maj. Donald Herod Peterson, USAF
Maj. Charles Gordon Fullerton, USAF
Col. James Benson Irwin, USAF
Fred Wallace Haise, Jr.
Lt. Col. Stuart Allen Roosa, USAF
Cdr. Edgar Dean Mitchell, USN
Maj. Henry Warren Hartsfield, Jr., USAF
Anthony Wayne England, Ph. D.
Lt. Col. Robert Franklyn Overmyer, USMC

Apollo 17
Maj. Charles Gordon Fullerton, USAF
Lt. Col. Robert Franklyn Overmyer
Robert Alan Ridley Parker, Ph. D.
Joseph Percival Allen, IV, Ph. D.
Capt. Alan Bartlett Shepard, Jr., USN
Cdr. Thomas Kenneth Mattingly, II, USN
Col. Charles Moss Duke, Jr., USAF
Lt. Col. Stuart Allen Roosa, USAF
Capt. John Watts Young, USN

14 *Chariots for Apollo*, NASA SP-4205; confirmed by various documents and memoranda in Rice University archives. Military ranks for astronauts who are not also backups are implied from available information and B. Hello (Rockwell) memo, 10 December 1969.

Support Crews[15]

Apollo 7
Lt. Cdr. Ronald Ellwin Evans, USN
Maj. William Reid Pogue, USAF
John Leonard Swigert, Jr.

Apollo 8
Vance DeVoe Brand
Lt. Cdr. Thomas Kenneth Mattingly, II, USN
Maj. Gerald Paul Carr, USMC

Apollo 9
Maj. Jack Robert Lousma, USMC
Lt. Cdr. Edgar Dean Mitchell, USN/Sc. D.
Maj. Alfred Merrill Worden, USAF

Apollo 10
Maj. Joe Henry Engle, USAF
Lt. Col. James Benson Irwin, USAF
Maj. Charles Moss Duke, Jr., USAF

Apollo 11
Lt. Cdr. Thomas Kenneth Mattingly, II, USN
Lt. Cdr. Ronald Ellwin Evans, USN
Maj. William Reid Pogue, USAF

Apollo 12
Maj. Gerald Paul Carr, USMC
Cdr. Paul Joseph Weitz, USN
Edward George Gibson, Ph. D.

Apollo 13
Maj. Jack Robert Lousma, USMC
Vance DeVoe Brand
Maj. William Reid Pogue, USAF

Apollo 14
Lt. Cdr. Bruce McCandless, II, USN
Lt. Col. William Reid Pogue, USAF
Maj. Charles Gordon Fullerton, USAF
Phillip Kenyon Chapman, Sc. D.

Apollo 15
Karl Gordon Henize, Ph. D.
Joseph Percival Allen, IV, Ph. D
Robert Alan Ridley Parker, Ph. D

Apollo 16
Maj. Donald Herod Peterson, USAF
Anthony Wayne England, Ph. D.
Maj. Henry Warren Hartsfield, Jr., USAF
Philip Kenyon Chapman, Sc. D.

Apollo 17
Lt. Col. Robert Franklyn Overmyer, USMC
Robert Alan Ridley Parker, Ph. D.
Maj. Charles Gordon Fullerton, USAF

15 Compiled from various documents and memoranda in the Rice University archives. For Apollo 7, Bill Pogue replaced Maj. Edward Galen Givens, Jr., USAF, who died in an automobile accident in Pearland, TX on 06 June 1967. Military ranks are implied from available information and B. Hello (Rockwell) memo, 10 December 1969.

Flight Directors[16]

Apollo 7	Directors
Shift #1	Glynn S. Lunney
Shift #2	Eugene F. Kranz
Shift #3	Gerald D. Griffin

Apollo 8	Directors
Shift #1	Clifford E. Charlesworth
Shift #2	Glynn S. Lunney
Shift #3	Milton L. Windler

Apollo 9	Directors
Shift #1	Eugene F. Kranz
Shift #2	Gerald D. Griffin
Shift #3	M. P. "Pete" Frank III

Apollo 10	Directors
Shift #1	Glynn S. Lunney
Shift #2	Gerald D. Griffin
Shift #3	Milton L. Windler
	M. P. "Pete" Frank III

Apollo 11	Directors
Shift #1	Clifford E. Charlesworth
	Gerald D. Griffin
Shift #2	Eugene F. Kranz
Shift #3	Glynn S. Lunney

Apollo 12	Directors
Shift #1	Gerald D. Griffin
Shift #2	M. P. "Pete" Frank III
Shift #3	Clifford E. Charlesworth
Shift #4	Milton L. Windler

Apollo 13	Directors
Shift #1	Milton L. Windler
Shift #2	Gerald D. Griffin
Shift #3	Eugene F. Kranz
Shift #4	Glynn S. Lunney

Apollo 14	Directors
Shift #1	M. P. "Pete" Frank III
	Glynn S. Lunney
Shift #2	Milton L. Windler
Shift #3	Gerald D. Griffin
Shift #4	Glynn S. Lunney

Apollo 15	Directors
Shift #1	Gerald D. Griffin
Shift #2	Milton L. Windler
Shift #3	Glynn S. Lunney
	Eugene F. Kranz

Apollo 16	Directors
Shift #1	M. P. "Pete" Frank III
	Philip C. Shaffer
Shift #2	Eugene F. Kranz
	Donald R. Puddy
Shift #3	Gerald D. Griffin
	Neil B. Hutchinson
	Charles R. Lewis

Apollo 17	Directors
Shift #1	Gerald D. Griffin
Shift #2	Eugene F. Kranz
	Neil B. Hutchinson
Shift #3	M. P. "Pete" Frank III
	Charles R. Lewis

16 Compiled from various documents and memoranda in the Rice University archives. According to Pete Frank, the initials "M.P." do not represent any names, per a telephone conversation between the author and Mr. Frank.

Apollo Space Vehicle Configuration[17]

S-IB (Apollo 7)

- Reached 1.640 million pounds of thrust at liftoff
- Accelerated total space vehicle to ~7,620 fps
- Reached ~33 nautical miles in ~ 2.5 minutes

S-IC

- Reached to 7.650 million pounds of thrust at liftoff
- Accelerated total space vehicle to ~7,880 fps
- Reached ~58 nautical miles in ~ 2.5 minutes

S-II interstage

- Interfaced first and second stages
- Housed second stage engines
- Provided ullage for S-II engine start

S-II

- Accelerated vehicle from ~7,880 fps to ~ 22,850 fps in ~370 sec.
- Achieved altitude of ~101 nautical miles
- Housed S-II retro-rocket mounting

S-IVB Interstage

- Provided structural transition from diameter of S-II to S-IVB
- Housed S-IVB engine
- Had attitude control about 3 axes and +X ullage with APS, up to 505 seconds of burn time

S-IVB

- Increased velocity from 7,620 fps to 25,553 fps in 470 sec to accomplish orbit (Apollo 7)
- Increased velocity from 22,850 fps to 25,568 fps in 154 sec to accomplish orbit (all other flights)
- Accelerated space vehicle to ~35,500 fps for TLI (all except Apollo 7 and Apollo 9)

Instrument Unit

- Provided launch vehicle guidance; navigation; control signals; telemetry; command communications; tracking; EDS rates and display activation timing and stage functional sequencing

Spacecraft/Lunar Module Adapter

- Housed and supported the LM, aerodynamically enclosed, supported LM
- Provided the structural electrical interface between spacecraft and launch vehicle
- Provided diameter transition from S-IVB to CSM
- Allowed LM extraction

Lunar Module Descent Stage

- Provided velocity change for lunar deorbit and lunar landing (throttleable)
- Protected ascent stage from landing damage
- Provided ascent stage /descent stage staging
- Provided LM ascent stage launch pad
- Stowed lunar scientific equipment

Lunar Module Ascent Stage

- Provided mission life support for 2 crewmen
- Contained secondary command control and communications
- Computed and performed lunar landing abort, launch, rendezvous and docking with CSM
- Facilitated CM, LM ingress/egress inter- and extra-vehicular activities
- Maneuvered about and along 3 axed in the near-lunar environment

Service Module

- Provided velocity change for course correction, lunar orbit insertion, transearth injection and CSM aborts
- Provided attitude control and translation
- Supplemented environmental, electrical power and reaction control requirements of CM

Command Module

- Provided mission life support for 3 crewmen
- Provided inertial/space-fixed navigation
- Provided command control and communication center
- Provided attitude control about 3 axes
- Acted as a limited lifting body
- Provided CM-LM ingress/egress for inter- and extra-vehicular activity

Launch Escape System

- Transported CM away from space vehicle (and mainland) during launch abort
- Oriented CM attitude for launch abort descent
- Jettisoned safely as required
- Sensed flight dynamics
- Provided CM thermal protection

17 Press kits, post-mission reports, and Saturn post-flight evaluation reports.

Originally published in “Apollo by the Numbers”, NASA SP-2000-4029, Revised February 2024

Designations[18]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Call-Signs											
Command Module	Apollo 7	Apollo 8	Gumdrop	Charlie Brown	Columbia	Yankee Clipper	Odyssey	Kitty Hawk	Endeavor	Casper	America
Lunar Module	---	---	Spider	Snoopy	Eagle	Intrepid	Aquarius	Antares	Falcon	Orion	Challenger
NASA/Contractor Designations											
Space Vehicle	AS-205	AS-503	AS-504	AS-505	AS-506	AS-507	AS-508	AS-509	AS-510	AS-511	AS-512
Launch Vehicle	SA-205	SA-503	SA-504	SA-505	SA-506	SA-507	SA-508	SA-509	SA-510	SA-511	SA-512
Launch Vehicle Type	Saturn IB	Saturn V	Saturn V	Saturn V	Saturn V	Saturn V	Saturn V	Saturn V	Saturn V	Saturn V	Saturn V
Launch Vehicle 1st Stage	S-IB-5	S-IC-3	S-IC-4	S-IC-5	S-IC-6	S-IC-7	S-IC-8	S-IC-9	S-IC-10	S-IC-11	S-IC-12
Launch Vehicle 2nd Stage	S-IVB-205	S-II-3	S-II-4	S-II-5	S-II-6	S-II-7	S-II-8	S-II-9	S-II-10	S-II-11	S-II-12
Launch Vehicle 3rd Stage	---	S-IVB-503	S-IVB-504	S-IVB-505	S-IVB-506	S-IVB-507	S-IVB-508	S-IVB-509	S-IVB-510	S-IVB-511	S-IVB-512
Instrument Unit	S-IU-205	S-IU-503	S-IU-504	S-IU-505	S-IU-506	S-IU-507	S-IU-508	S-IU-509	S-IU-510	S-IU-511	S-IU-512
Spacecraft/LM Adapter	SLA-5	SLA-11A	SLA-12A	SLA-13A	SLA-14	SLA-15	SLA-16	SLA-17	SLA-19	SLA-20	SLA-21
Command Module	CM-101	CM-103	CM-104	CM-106	CM-107	CM-108	CM-109	CM-110	CM-112	CM-113	CM-114

18 Compiled from *RAE Table of Earth Satellites 1957-1986*; press kits; mission implementation plans; Saturn V flight evaluation reports; *Apollo Program Summary Report*; *Stages to Saturn: A Technological History of the Apollo/Saturn Launch Vehicles*; and other sources. Computer program names provided by David Baker.

Service Module	SM-101	SM-103	SM-104	SM-106	SM-107	SM-108	SM-109	SM-110	SM-112	SM-113	SM-114
Lunar Module	---	(LTA-B[19])	LM-3	LM-4	LM-5	LM-6	LM-7	LM-8	LM-10	LM-11	LM-12
Lunar Roving Vehicle	---	---	---	---	---	---	---	---	LRV-1	LRV-2	LRV-3
VAB High Bay	---	1	3	2	1	3	1	3	3	3	3
Firing Room	---	1	2	3	1	2	1	2	1	1	1
Mobile Launcher Platform	---	MLP-1	MLP-2	MLP-3	MLP-1	MLP-2	MLP-3	MLP-2	MLP-3	MLP-3	MLP-3
Computer Programs – CSM	Sundisk	Colossus	Colossus	Colossus 2	Comanche 55	Colossus 2C	Comanche 72 Rev. 3	Colossus 2E	Colossus 3	Colossus 3	Colossus 3
– LM	Sundisk		Sundance	Luminary 1	Luminary 99	Luminary 116	Luminary 131 Rev. 9	Luminary 1D	Luminary 1E	Luminary 1E	Luminary 1G
Eastern Test Range Number	66	170	9025	920	5307	2793	3381	7194	7744	1601	1701
International Designations											
CSM	1968-089A	1968-118A	1969-018A	1969-043A	1969-059A	1969-099A	1970-029A	1971-008A	1971-063A	1972-031A	1972-096A
S-IVB Stage	1968-089B	1968-118B	1969-018B	1969-043B	1969-059B	1969-099B	1970-029B	1971-008B	1971-063B	1972-031B	1972-096B
LM Ascent Stage[20]	---	---	1969-018C	1969-043D	1969-059C	1969-099C	1970-029C	1971-008C	1971-063C	1972-031C	1972-096C
LM Descent Stage	---	---	1969-018D	1969-043C	1969-059D	1969-099D	1970-029C	1971-008D	1971-063E	1972-031E	1972-096D
Lunar Subsatellite	---	---	---	---	---	---	---	---	1971-063D	1972-031D	---
NORAD Designations											
CSM	03486	03626	03769	03941	04039	04225	04371	04900	05351	06000	06300
S-IVB Stage	03487	03627	03770	03943	04040	04226	04372	04904	05352	06001	06301
LM Ascent Stage	---	---	03771	03949	04041	04246	---	04905	05366	06005	06307
LM Descent Stage	---	---	03780	03948	---	---	---	---	---	---	---
Lunar Subsatellite	---	---	---	---	---	---	---	---	05377	06009	---

19 Lunar Module Test Article (LTA)

20 Ascent and descent stages for Apollo 13 remained docked throughout the mission and were jettisoned together.

Launch Vehicle/Spacecraft Key Facts[21]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
First Stage (S-IB)											
Contractor	Chrysler	---	---	---	---	---	---	---	---	---	---
Diameter, base, ft	21.500	---	---	---	---	---	---	---	---	---	---
Diameter, top, ft	21.667	---	---	---	---	---	---	---	---	---	---
Height, ft	80.200	---	---	---	---	---	---	---	---	---	---
Engines, type/number	H-1/8	---	---	---	---	---	---	---	---	---	---
Fuel	RP-1	---	---	---	---	---	---	---	---	---	---
Oxidizer	LO_2										
Rated thrust each engine, lbf	200.000	---	---	---	---	---	---	---	---	---	---
Rated thrust total, lbf	1,600,000	---	---	---	---	---	---	---	---	---	---
Thrust at 35 to 38 sec, lbf	1,744,400	---	---	---	---	---	---	---	---	---	---
First Stage (S-IC)											
Contractor	---	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing
Diameter, base, ft	---	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000
Diameter, top, ft	---	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000
Height, ft	---	138.030	138.030	138.030	138.030	138.030	138.030	138.030	138.030	138.030	138.030
Engines, type/number	---	F-1/5	F-1/5	F-1/5	F-1/5	F-1/5	F-1/5	F-1/5	F-1/5	F-1/5	F-1/5
Fuel	---	RP-1	RP-1	RP-1	RP-1	RP-1	RP-1	RP-1	RP-1	RP-1	RP-1
Oxidizer	---	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2
Rated thrust each engine, lbf	---	1,500,000	1,522,000	1,522,000	1,522,000	1,522,000	1,522,000	1,522,000	1,522,000	1,522,000	1,522,000
Rated thrust total, lbf	---	7,500,000	7,610,000	7,610,000	7,610,000	7,610,000	7,610,000	7,610,000	7,610,000	7,610,000	7,610,000
Thrust at 35 to 38 sec, lbf	---	7,560,000	7,576,000	7,536,000	7,552,000	7,594,000	7,560,000	7,504,000	7,558,000	7,620,000	7,599,000
Second Stage (S-II)											
Contractor	---	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell
Diameter, ft	---	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000
Height, ft	---	81.500	81.500	81.500	81.500	81.500	81.500	81.500	81.500	81.500	81.500
Engines, type/number	---	J-2/5	J-2/5	J-2/5	J-2/5	J-2/5	J-2/5	J-2/5	J-2/5	J-2/5	J-2/5
Fuel	---	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2
Oxidizer	---	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2
Rated thrust each engine, lbf	---	225,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000
Rated thrust total, lbf	---	1,125,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000
Thrust, ESC +61 sec, lbf[22]	---	1,143,578	1,155,611	1,159,477	1,155,859	1,161,534	1,160,767	1,164,464	1,169,662	1,163,534	1,156,694
Thrust, OECO, lbf	---	865,302	730,000	642,06	625,751	611,266	635,725	580,478	548,783	787,380	787,009

21 Compiled from Saturn launch vehicle flight evaluation reports. Thrust for S-IC stage is at sea level and for the S-II and S-IVB stages is at altitude. Thrust listed at “35 to 38 sec”, “Engine Start Command + 61 seconds”, and at “Outboard Engine Cutoff” is actual thrust as flown.

22 ESC is “engine start command”; OECO is “outboard engine cutoff”.

Launch Vehicle/Spacecraft Key Facts

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Third Stage (S-IVB) (2nd stage for Apollo 7)											
Contractor	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas
Diameter, ft (base)	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000	33.000
Diameter, ft (top)	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667
Height, ft	58.400	58.630	58.630	58.630	58.630	58.630	58.630	58.630	58.630	58.630	58.630
Engines, type/number	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1	J-2/1
Fuel	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2	LH_2
Oxidizer	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2	LO_2
Rated thrust total, lbf	200,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000	230,000
Thrust, lbf - 1st burn	207,802	202,678	232,366	204,965	202,603	206,956	199,577	201,572	202,965	206,439	205,797
Thrust, lbf - 2nd burn	---	201,777	203,568	204,712	201,061	207,688	198,536	201,738	203,111	206,807	205,608
Thrust, lbf - 3rd burn	---	---	199,516	---	---	---	---	---	---	---	---
Instrument Unit (IU)											
Contractor	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM
Diameter, ft	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667
Height, ft	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Service Module (SM)											
Contractor	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell	N Am. Rockwell
Diameter, ft	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833
Height (with engine bell), ft	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583
Height (engine bell), ft	9.750	9.750	9.750	9.750	9.750	9.750	9.750	9.750	9.750	9.750	9.750

Fairing, ft	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583	24.583
Main structure, ft	1.917	1.917	1.917	1.917	1.917	1.917	1.917	1.917	1.917	1.917	1.917
SPS nozzle structure	12.917	12.917	12.917	12.917	12.917	12.917	12.917	12.917	12.917	12.917	12.917
Weight, lb	19,730	51,258	36,159	51,371	51,243	51,105	51,105	51,744	54,063	54,044	54,044
Weight, dry, lb									13,470	13,450	13,450
Propellant, lb									40,593	40,594	40,594
Rated Thrust, SPS engine, lbf	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500	20,500
Spacecraft/LM Adapter											
Contractor	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman
Minimum diameter, ft	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833
Maximum diameter, ft	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667	21.667
Height, ft	28.000	27.999	27.999	27.999	27.999	27.999	27.999	27.999	27.999	27.999	27.999
Upper jettisonable panels, ft	21.129	21.208	21.208	21.208	21.208	21.208	21.208	21.208	21.208	21.208	21.208
Lower fixed panels, ft	6.871	6.791	6.791	6.791	6.791	6.791	6.791	6.791	6.791	6.791	6.791
Lunar Module (LM)											
Contractor	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman	Grumman
Overall											
Width, ft	---	---	31.000	31.000	31.000	31.000	31.000	31.000	31.000	31.000	31.000
Height, ft	---	---	22.917	22.917	22.917	22.917	22.917	22.917	22.917	22.917	22.917
Footpad diameter, ft	---	---	3.083	3.083	3.083	3.083	3.083	3.083	3.083	3.083	3.083
Sensing probe length, ft	---	---	5.667	5.667	5.667	5.667	5.667	5.667	5.667	5.667	5.667
Weight (lb)	---	(LTA) 19,900	32,034	30,735	33,278	33,562	33,493	33,685	36,238	36,237	36,262

Launch Vehicle/Spacecraft Key Facts

	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
LM Descent Stage	---									
Diameter, ft	---	14.083	14.083	14.083	14.083	14.083	14.083	14.083	14.083	14.083
Height, ft	---	10.583	10.583	10.583	10.583	10.583	10.583	10.583	10.583	10.583
Weight, dry, lb[23]	---	4,265	4,703	4,483	4,875	4,650	4,716	6,179	6,083	6,155
Maximum rated thrust, lb	---	9,870	9,870	9,870	9,870	9,870	9,870	9,870	9,870	9,870
LM Ascent Stage	---									
Diameter, ft	---	14.083	14.083	14.083	14.083	14.083	14.083	14.083	14.083	14.083
Height, ft	---	12.333	12.333	12.333	12.333	12.333	12.333	12.333	12.333	12.333
Cabin volume, cu ft	---	235	235	235	235	235	235	235	235	235
Habitable volume, cu ft	---	160	160	160	160	160	160	160	160	160
Crew compartment height, ft	---	7.667	7.667	7.667	7.667	7.667	7.667	7.833	7.833	7.833
Crew compartment depth, ft	---	3.500	3.500	3.500	3.500	3.500	3.500	3.500	3.500	3.500
Weight, dry, lb	---	5,071	4,781	4,804	4,760	4,668	4,691	4,690	4,704	4,729
Maximum rated thrust, lb	---	2,524	1,650	3,218	3,224	N/A	3,218.2	3,225.6	3,224.7	3,234.8
Lunar Rover Vehicle (LRV)										

23 LM ascent and descent stages, LRV and CM dry weights are as published in mission press kits. All other weights are “as flown”.

Contractor	---	---	---	---	---	---	---	Boeing	Boeing	Boeing
Length, ft	---	---	---	---	---	---	---	10.167	10.167	10.167
Width, ft	---	---	---	---	---	---	---	6.000	6.000	6.000
Wheel base, ft	---	---	---	---	---	---	---	7.500	7.500	7.500
Weight, lb	---	---	---	---	---	---	---	462	462	462
Payload capacity, lb	---	---	---	---	---	---	---	1,080	1,080	1,080
Command Module (CM)										
Contractor	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell
Diameter, ft	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833	12.833
Height, ft	11.417	11.417	11.417	11.417	11.417	11.417	11.417	11.417	11.417	11.417
Docking probe cone, ft	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583	2.583
Main structure, ft	6.750	6.750	6.750	6.750	6.750	6.750	6.750	6.750	6.750	6.750

Aft/heat shield, ft	2.083	2.083	2.083	2.083	2.083	2.083	2.083	2.083	2.083	2.083
Weight, lb	12,392	12,405	12,277	12,250	12,365	12,365	12,831	12,831	12,874	12,874
Habitable volume, cu ft	210	210	210	210	210	210	210	210	210	210
Launch Escape System (LES)										
Contractor	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell	N. Am. Rockwell
Diameter, ft	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
Height, ft	33.460	33.460	33.460	33.460	33.460	33.460	33.460	33.460	33.460	33.460
Rocket motors (1 each)										
Thrust, LES, lb	147,000	147,000	147,000	147,000	147,000	147,000	147,000	147,000	147,000	147,000
Thrust, pitch control motor, lb	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Thrust tower jettison motor, lb	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500

Total Vehicle Height (ft)	**363.013**	**363.013**	**363.013**	**363.013**	**363.013**	**363.013**	**363.013**	**363.013**	**363.013**	**363.013**

Launch Windows[24]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Launch Window Opening											
KSC Date	11 Oct 1968	21 Dec 1968	03 Mar 1969	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	06 Dec 1972
KSC Time	11:00:00 a.m.	07:50:22 a.m.	11:00:00 a.m.	12:49:00 p.m.	09:32:00 a.m.	11:22:00 a.m.	02:13:00 p.m.	03:23:00 p.m.	09:34:00 a.m.	12:54:00 p.m.	09:53:00 p.m.
Time Zone	EDT	EST	EST	EDT	EDT	EST	EST	EST	EDT	EST	EST
GMT Date	11 Oct 1968	21 Dec 1968	03 Mar 1969	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
GMT Time	16:00:00	12:50:22	16:00:00	16:49:00	13:32:00	16:22:00	19:13:00	20:23:00	13:34:00	17:54:00	02:53:00
Launch Window Closing											
KSC Date	11 Oct 1968	21 Dec 1968	03 Mar 1969	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
KSC Time	03:00:00 p.m.	12:31:40 p.m.	02:15:00 p.m.	05:09:00 p.m.	01:54:00 p.m.	02:28:00 p.m.	05:36:00 p.m.	07:12:00 p.m.	12:11:00 p.m.	04:43:00 p.m.	01:31:00 a.m.
Time Zone	EDT	EST	EST	EDT	EDT	EST	EST	EST	EDT	EST	EST
GMT Date	11 Oct 1968	21 Dec 1968	03 Mar 1969	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	01 Feb 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
GMT Time	20:00:00	17:31:40	19:15:00	21:09:00	17:54:00	19:28:00	22:36:00	00:12:00	16:11:00	21:43:00	06:31:00
Window Duration											
H:MM:SS	4:00:00	4:41:18	3:15:00	4:20:00	4:22:00	3:06:00	3:23:00	3:49:00	3:37:00	3:49:00	3:38:00
Minutes	240	281	195	260	262	186	203	229	217	229	218
Targeted Lunar Sun Elevation Angle (deg)	---	6.74	---	11.0	10.8	5.1	10.0	10.3	12.0	11.9	13.3

24 Compiled from press kits, mission implementation plans, and mission reports.

Launch Weather[25]

	Apollo 7	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Surface Observations										
Pressure (lb/in²)	14.765	14.642	14.779	14.798	14.621	14.676	14.652	14.788	14.769	14.795
Temperature (°F)	82.9	67.3	80.1	84.9	68.0	75.9	71.1	85.6	88.2	70.0
Relative Humidity	65%	61%	75%	73%	92%	57%	86%	68%	44%	93%
Dew Point (°F)	70	53	72	75	65	60	67	74	62.6	68.0
Visibility (s mi)	11.5	9.9	11.2	9.9	3.7	9.9	9.9	9.9	9.9	6.8
Surface Wind Conditions										
1st Level Wind Site (ft)	64.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
1st Level Wind Speed (ft/sec)	33.5	22.6	32.2	10.8	22.3	20.7	16.4	16.7	20.7	13.5
1st Level Wind Direction (deg)	090	160	142	175	280	105	255	156	269	005
2nd Level Wind Site (ft)	N/R[26]	N/R	N/R	N/R	N/R	N/R	530.0	530.0	530.0	530.0
2nd Level Wind Speed (ft/sec)	N/R	N/R	N/R	N/R	N/R	N/R	27.9	17.7	16.7	17.7
2nd Level Wind Direction (deg)	N/R	N/R	N/R	N/R	N/R	N/R	275	158	256	335
Cloud Coverage										
1st Level Cover	30%	70%	40%	10%	100%/rain	40%	70%	70%	20%	20%

25 Compiled from Saturn launch vehicle reports, trajectory reconstruction reports, and *Summary of Atmospheric Data Observations For 155 Flights of MSFC/ABMA Related Aerospace Vehicles*.

26 NR stands for "Not Recorded". This measurement was not used for this mission or not recorded at launch time.

1st Level Type	Cumulonimbus	Stratocumulus	Cumulus	Cumulus	Stratocumulus	Altocumulus	Cumulus	Cirrus	Cumulus	Stratocumulus
1st Level Altitude (ft)	2,100	3,500	2,200	2,400	2,100	19,000	4,000	25,000	3,000	26,000
2nd Level Cover	---	100%	20%	20%	---	100%	20%	---	---	50%
2nd Level Type	---	Altostratus	Altocumulus	Altocumulus	---	Cirrostratus	Altocumulus	---	---	Cirrus
2nd Level Altitude (ft)	---	9,000	11,000	15,000	---	26,000	8,000	---	---	26,000
3rd Level Cover	---	---	100%	90%	---	---	---	---	---	---
3rd Level Type	---	---	Cirrus	Cirrostratus	---	---	---	---	---	---
3rd Level Altitude (ft)	---	---	Unknown	Unknown	---	---	---	---	---	---
Maximum Wind Speed/Ascent										
Speed (ft/sec)	136.2	250.0	154	203	256	246	207	249.3	85.6	252.6
Altitude (ft)	172,000	38,480	295,276	183,727	180,446	256,562	193,570	182,900	38,880	145,996
Maximum Dynamic Pressure										
Ground Elapsed Time (sec)	75.5	85.5	82.6	83.0	81.1	81.3	81.0	82.0	86.0	82.5
Max q (lb/ft^2)	665.60	630.73	694.232	735.17	682.95	651.63	655.8	768.58	726.81	701.75
Altitude (ft)	39,903	45,138	43,366	44,512	42,133	40,876	40,398	44,971	47,122	42,847

Maximum Wind Conditions in High Dynamic Pressure Region										
Altitude (ft)	44,500	38,480	46,520	37,400	46,670	44,540	43,270	45,110	38,880	39,945
Wind Speed (ft/sec)	51.1	250.0	139.4	31.6	156.1	182.5	173.2	61.1	85.6	147.9
Wind Direction (deg)	309	264	270	297	245	252	255	063	257	311
Maximum Wind Components										
Pitch Plane - Pitch (ft/sec)	51.8	244.4	133.9	24.9	154.9	182.4	173.2	-58.4	85.3	114.2
Pitch Plane - Altitude (ft)	36,800	38,390	45,280	36,680	46,670	44,540	43,720	45,030	38,880	39,945
Yaw Plane - Yaw (ft/sec)	51.5	71.2	61.4	23.3	-64.0	49.2	81.7	24.0	41.0	95.8
Yaw Plane - Altitude (ft)	47,500	37,500	48,720	39,530	44,780	42,750	33,460	44,040	50,850	37,237

Launch Weather[27]

	Apollo 7	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Maximum Shear Values (Δ h=1000 m)										
Pitch Plane Shear (sec^{-1})	0.0113	0.0248	0.0203	0.0077	0.0183	0.0166	0.0201	0.0110	0.0095	0.0177
Pitch Plane Altitude (ft)	48,100	49,700	50,200	48,490	46,750	50,610	43,720	36,830	44,780	26,164
Yaw Plane Shear (sec^{-1})	0.0085	0.0254	0.0125	0.0056	0.0178	0.0178	0.0251	0.0071	0.0114	0.0148
Yaw Plane Altitude (ft)	46,500	48,160	50,950	33,790	47,820	45,850	38,880	47,330	50,850	34,940
Maximum % Density Deviations										
Negative Deviation From PRA63[28]	-0.1	-6.1	-1.0	-0.2	-7.6	-2.8	-5.0	None	-0.8	-0.0
Altitude (n mi)	4.32	7.56	4.32	4.45	8.50	7.69	7.69	None	4.86	0.00
Positive Deviation from PRA63	+1.3	None	+3.3	+4.4	+1.2	+0.5	None	+4.2	+4.0	+1.7
Altitude (n mi)	5.80	None	7.56	7.69	5.67	8.64	None	7.56	8.64	7.02

27 Compiled from Saturn launch vehicle reports, trajectory reconstruction reports, and *Summary of Atmospheric Data Observations For 155 Flights of MSFC/ABMA Related Aerospace Vehicles*.

28 Patrick Air Force Base Reference Atmosphere, 1963.

Apollo Program Budget Appropriations ($000)[29]

	1960	1961	1963	19641965	1966	1967	1968	1969	1970	1971	1972	1973	Program Total
Advanced Technical Development Studies	$100	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,100
Orbital Flight Tests	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$63,900
Biomedical Flight Tests	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$16,550
High-Speed Reentry Tests	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$27,550
Spacecraft Development	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$52,000
Instrumentation & Scientific Equipment	$0	$0	$11,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,500
Operational Support	$0	$0	$2,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,500
Little Joe II Development	$0	$0	$8,800	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,800
Supporting Development	$0	$0	$3,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,000
Command and Service Modules	$0	$0	$345,000	$545,874	$615,000	$560,400	$455,300	$346,000	$282,821	$0	$0	$0	$3,728,229
Lunar Module	$0	$0	$123,100	$135,000	$310,800	$472,500	$399,600	$326,000	$231,433	$0	$0	$0	$2,241,033

29 *The Apollo Spacecraft: A Chronology, volumes I through IV*.

Guidance & Navigation	$0	$0	$32,400	$600,000	$91,499	$81,038	$115,000	$76,654	$113,000	$43,900	$33,866	$0	$0	$0	$587,357
Integration, Reliability, & Checkout	$0	$0	$0	$60,699	$24,763	$34,400	$29,975	$66,600	$65,100	$0	$0	$0	$0	$281,537
Spacecraft Support	$0	$0	$0	$43,503	$83,663	$95,400	$110,771	$60,500	$121,800	$170,764	$0	$0	$0	$686,401
Saturn C-1	$0	$0	$90,864	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$90,864
Saturn I	$0	$0	$0	$187,077	$40,265	$800	$0	$0	$0	$0	$0	$0	$0	$228,142
Saturn IB	$0	$0	$0	$146,817	$262,690	$274,185	$236,600	$146,600	$41,347	$0	$0	$0	$0	$1,108,239
Saturn V	$0	$0	$0	$763,382	$964,924	$1,177,320	$1,135,600	$998,900	$534,453	$484,439	$189,059	$142,458	$26,300	$6,416,835
Engine Development	$0	$0	$0	$166,000	$166,300	$134,095	$49,800	$18,700	$0	$0	$0	$0	$0	$534,895
Apollo Mission Support	$0	$0	$0	$133,101	$17	$210,385	$243,900	$296,800	$0	$0	$0	$0	$0	$1,054,728

				$0,542									
Manned Space Flight Operations	$0	$0	$0	$0	$0	$0	$0	$546,400	$422,728	$314,963	$307,450	$0	$1,591,541
Advanced Development	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,500	$12,500	$0	$24,000
Flight Modules	$0	$0	$0	$0	$0	$0	$0	$0	$0	$245,542	$55,033	$0	$300,575
Science Payloads	$0	$0	$0	$0	$0	$0	$0	$0	$60,094	$106,194	$52,100	$0	$218,388
Ground Support	$0	$0	$0	$0	$0	$0	$0	$0	$0	$46,411	$31,659	$0	$78,070
Spacecraft	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$50,400	$50,400
Apollo Program	**$100**	**$1,000**	**$617,164**	**$2,272,952**	**$2,967,385**	**$2,916,200**	**$2,556,000**	**$2,025,000**	**$1,686,145**	**$913,669**	**$601,200**	**$76,700**	**$19,408,134**
NASA Total	**$523,575**	**$964,000**	**$3,674,115**	**$3,974,979**	**$4,511,644**	**$4,175,100**	**$3,970,000**	**$3,193,559**	**$3,113,765**	**$2,555,000**	**$2,517,700**	**$2,509,900**	**$56,661,332**
Apollo Share of Total Budget	**<1%**	**<1%**	**17%**	**57%**	**66%**	**70%**	**64%**	**63%**	**54%**	**36%**	**24%**	**3%**	**34%**

Call Signs[30]

Mission	Command Module	Lunar Module
Apollo 7	"Apollo 7".	None.
Apollo 8	"Apollo 8".	None.
Apollo 9	"Gumdrop". Derived from the appearance of the spacecraft when transported on Earth. During shipment, it was wrapped in blue wrappings giving appearance of a wrapped gumdrop.	"Spider", derived from its buglike configuration.
Apollo 10	"Charlie Brown", from a character in comic strip *Peanuts*© drawn by Charles L. Schulz. As in the comic, the CM "Charlie Brown" would be the guardian of the LM "Snoopy."	"Snoopy," after the beagle dog character in the same comic strip. The name referred to the fact that the LM would be "snooping" around the lunar surface in low orbit. Also, at the Manned Spacecraft Center, Snoopy was symbol of quality performance. Employees who did outstanding work were awarded a silver Snoopy pin.
Apollo 11	"Columbia", after "Columbiad", the canon used to launch Jules Verne's moonship (commonly thought to be the moonship itself which was referred to only as "the projectile"); also used because of the close relationship of the word to the United States' origins.	"Eagle," after the eagle selected for the mission insignia.
Apollo 12	"Yankee Clipper", selected from names submitted by employees of the command module prime contractor.	"Intrepid", selected from names submitted by employees of the lunar module prime contractor.
Apollo 13	"Odyssey," reminiscent of the long voyage of Odysseus of Greek mythology.	"Aquarius," after the Egyptian god Aquarius, the water carrier. Aquarius brought fertility and therefore life and knowledge to the Nile Valley, as the Apollo 13 crew hoped to bring knowledge from the Moon.
Apollo 14	"Kitty Hawk", the site of the Wright brothers' first flight in Kitty Hawk, NC.	"Antares", for the star on which the LM oriented itself for lunar landing.
Apollo 15	"Endeavor," for the ship which carried Captain James Cook on his 18th-century scientific voyages.	"Falcon," named for the USAF Academy mascot by Apollo 15's all-Air Force crew.
Apollo 16	"Casper", named for a cartoon character, "Casper the Friendly Ghost," because the white Teflon suits worn by the crew looked shapeless on television screens.	"Orion," for a constellation, because the crew would depend on star sightings to navigate in cislunar space.
Apollo 17	"America", as a tribute and a symbol of thanks to the American people who made the Apollo program possible.	"Challenger," indicative of the challenges of the future, beyond the Apollo program.

30 Excerpted from *Astronaut Mission Patches and Spacecraft Callsigns*, by Dick Lattimer, unpublished draft in JSC History Office; *Space Patches From Mercury to the Space Shuttle*; and various NASA documents.

Mission Insignias[31]

Project Apollo

The Project Apollo insignia was a disk circumscribed by a band displaying the words "Apollo" and "NASA." The center disk bore a large letter "A" with the constellation Orion positioned so that its three central stars formed the bar of the letter. To the right was the Earth, with the Moon in the upper left of the center disc. The Moon's face represented the mythical god Apollo. A double trajectory passed behind both spheres and through the central stars.

Apollo 1

The insignia for the first piloted Apollo flight depicted an Apollo spacecraft in Earth orbit. In the background were the stars and stripes of the U.S. flag. The crew members' names appeared in the inner border. The Moon appeared at the right, reminding us of the project goal.

Apollo 7

Symbolizing the Earth-orbital nature of the mission, a CSM circled the globe trailing an ellipse of orange flame. The background was navy-blue, symbolizing the depth of space. In the center, the Earth, with North and South America appearing against light blue oceans. The crew's names appeared in an arc at the bottom. A Roman numeral VII appeared in the Pacific region of the globe.

Apollo 8

The shape of the insignia symbolized the Apollo CM. The red figure 8 circled the Earth and Moon, representing not only the number of the mission but the translunar and transearth trajectories.

Apollo 9

Orbiting near the CM, the LM symbolized the first piloted flight of the spacecraft that would take humans to the lunar surface. A Saturn V was at the left. The crew names appeared around the top of the insignia, and the mission name appeared along the bottom. The 'D' in McDivitt had a red interior identifying this as the "D" mission in the Apollo series.

Apollo 10

The shield-shaped insignia was based more on mechanics than on mission goals. The three-dimensional Roman numeral X identified the mission and gave the effect of sitting on the Moon. The CM circled the Moon as the LM made its low pass over the surface, with the Earth in the background. Although Apollo 10 did not land, the prominence of the X indicated the mission would make a significant contribution to the Apollo program.

Apollo 11

The American eagle, symbolic of the United States, was about to land on the Moon. In its talons, an olive branch indicated the crew "came in peace for all mankind." The Earth, the place from which the crew came and would return safely in order to fulfill President John F. Kennedy's challenge to the nation, rested on a field of black, representing the vast unknown of space.

Apollo 12

An American clipper ship and blue-and-gold motif signified an all-Navy crew and related the era of the clipper ship to the era of space flight. As the clipper brought foreign shores closer to the U.S., and marked our increased utilization of the seas, spacecraft opened the way to other planets. Apollo 12 marked the increased utilization of space based on knowledge gained in earlier missions. The portion of the Moon shown represented the Ocean of Storms area in which Apollo would land. The four stars represented the crew and C. C. Williams, original LMP who died in an air crash.

Apollo 13

Apollo, the sun god of Greek mythology, was represented as the sun, with three horses driving his chariot across the surface of the Moon, symbolizing how the Apollo flights have extended the light of knowledge to all mankind. The Latin phrase "Ex Luna, Scientia" means "From the Moon, Knowledge."

Apollo 14

The Apollo 14 insignia featured the astronaut insignia approaching the Moon and leaving a comet trail from the liftoff point on Earth. The mission name and crew name appeared in the border.

Apollo 15

Three stylized birds, or symbols of flight, representing the Apollo 15 crew, were superimposed over an artist's concept of the landing site, next to the Hadley Rille at the foot of the Lunar Apennines. To the right of the symbols, was an "XV", signifying the mission number.

Apollo 16

Resting on a gray field representing the lunar surface, the American eagle and red, white and blue striped shield paid tribute to the people of the United States. Crossing the shield while orbiting the Moon was a gold NASA vector. Sixteen stars, representing the mission number, and the crew names, appeared on a blue border, outlined in gold.

Apollo 17

The insignia was dominated by the image of Apollo, the Greek sun god. Suspended in space behind the head of Apollo was an American eagle of contemporary design, the red bars of the eagle's wing represented the bars in the U.S. flag; the three white stars symbolized the three astronaut crewmen. The background was deep blue space and within it were the Moon, the planet Saturn and a spiral galaxy or nebula. The Moon was partially overlaid by the eagle's wing suggesting that this was a celestial body that man has visited and in that sense conquered. The thrust of the eagle and the gaze of Apollo to the right and toward Saturn and the galaxy was meant to imply that man's goals in space would someday include the planets and perhaps the stars. The colors of the emblem were red, white and blue, the colors of the U.S. flag; with the addition of gold, to symbolize the golden age of space flight that would begin with this Apollo 17 lunar landing. The Apollo image used in this insignia was the Apollo of Belvedere sculpture that was in the Vatican Gallery in Rome. This emblem was designed by artist Robert T. McCall in collaboration with the astronauts.

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31 Excerpted and edited from *Astronaut Mission Patches and Spacecraft Callsigns*, by Dick Lattimer, unpublished draft in JSC History Office; *Space Patches From Mercury to the Space Shuttle*; and various NASA documents.

Ground Ignition Weights[32]

Weights In Pounds Mass	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Ground Ignition Time Relative to Range Zero (sec)	**-2.988**										**-6.9**
S-IB stage, dry	84,530	---	---	---	---	---	---	---	---	---	---
S-IB stage, oxidizer	631,300	---	---	---	---	---	---	---	---	---	---
S-IB stage, fuel	276,900	---	---	---	---	---	---	---	---	---	---
S-IB stage, other	1,182	---	---	---	---	---	---	---	---	---	---
S-IB stage, total	**993,912**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
S-IB/S-IVB interstage, dry	**5,543**	---	---	---	---	---	---	---	---	---	---
Retromotor Propellant	1,061	---	---	---	---	---	---	---	---	---	---
S-IC stage, dry	---	305,232	294,468	293,974	287,531	287,898	287,899	287,310	286,208	287,855	287,356
S-IC stage, oxidizer	---	3,128,034	3,301,203	3,302,827	3,305,786	3,310,199	3,304,734	3,312,769	3,312,030	3,311,226	3,314,388
S-IC stage, fuel	---	1,357,634	1,431,678	1,423,254	1,424,889	1,424,287	1,431,384	1,428,561	1,410,798	1,439,894	1,431,921
S-IC stage, other	---	6,226	5,508	5,491	5,442	5,442	5,401	5,194	4,283	5,396	5,395
S-IC stage, total	**---**	**4,797,126**	**5,032,857**	**5,025,546**	**5,023,648**	**5,027,826**	**5,029,418**	**5,033,834**	**5,013,319**	**5,044,371**	**5,039,060**
S-IC/S-II interstage, dry	**---**	**12,436**	**11,591**	**11,585**	**11,477**	**11,509**	**11,454**	**11,400**	**9,083**	**10,091**	**9,975**
S-II stage, dry	---	88,500	84,312	84,273	79,714	80,236	77,947	78,120	78,908	80,362	80,423
S-II stage, oxidizer	---	793,795	821,504	823,325	819,050	825,4	836,741	837,484	837,991	846,157	844,094

32 Actual weights at S-IC stage ignition, compiled from Saturn launch vehicle flight evaluation reports. Weights to do not add to vehicle totals due to truncated decimal data in report.

S-II stage, fuel	---	154,907	158,663	158,541	158,116	106 157,986	159,931	159,232	158,966	160,551	160,451
S-II stage, other	---	1,426	1,188	1,250	1,260	1,250	1,114	1,051	1,082	991	934
S-II stage, total	**---**	**1,038,628**	**1,065,667**	**1,067,389**	**1,058,140**	**1,064,878**	**1,075,733**	**1,075,887**	**1,076,947**	**1,088,061**	**1,085,902**
S-II/S-IVB interstage, dry	**---**	**8,731**	**7,998**	**8,045**	**8,076**	**8,021**	**8,081**	**8,060**	**8,029**	**8,055**	**8,019**
S-IVB stage, dry	21,852	25,926	25,089	25,680	24,852	25,064	25,097	25,030	25,198	25,099	25,040
S-IVB stage, oxidizer	193,330	192,840	189,686	192,089	192,497	190,587	191,890	190,473	195,788	195,372	195,636
S-IVB stage, fuel	39,909	43,395	43,709	43,388	43,608	43,663	43,657	43,546	43,674	43,727	43,752
S-IVB stage, other	1,432	1,626	1,667	1,684	1,656	1,873	1,673	1,687	1,655	1,643	1,658
S-IVB stage, total	**256,523**	**263,787**	**260,151**	**262,841**	**262,613**	**261,187**	**262,317**	**260,736**	**266,315**	**265,841**	**266,086**
Total Instrument Unit	**4,263**	**4,842**	**4,281**	**4,267**	**4,275**	**4,277**	**4,502**	**4,505**	**4,487**	**4,502**	**4,470**
Spacecraft/Lunar Module Adapter	3,943	3,951	4,012	3,969	3,951	3,960	3,947	3,962	3,964	3,961	3,961
LM (LTA Apollo 8)	---	19,900	32,034	30,735	33,278	33,562	33,493	33,685	36,238	36,237	36,262
Command and Service Module	32,495	63,531	59,116	63,560	63,507	63,559	63,795	64,448	66,925	66,949	66,942
Total Launch Escape System	8,874	8,890	8,869	8,936	8,910	8,963	8,991	9,027	9,108	9,167	9,104
Total Spacecraft (CSM)	**45,312**	**96,272**	**104,031**	**107,200**	**109,646**	**110,044**	**110,226**	**111,122**	**116,235**	**116,314**	**116,269**
Total Vehicle	**1,306,614**	**6,221,823**	**6,486,577**	**6,486,873**	**6,477,875**	**6,487,742**	**6,501,733**	**6,505,548**	**6,494,415**	**6,537,238**	**6,529,784**

Ascent Data[33]

	Apollo 8	Apollo 9	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Pre-Staging									
Pad Azimuth (deg East of North)	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Flight Azimuth (deg East of North)	72.124	72.0	72.058	72.029	72.043	75.558	80.088	72.034	91.503
Mach 1 - GET (sec)	61.48	68.2	66.3	66.1	68.4	68.0	65.0	67.5	67.5
Mach 1 Altitude (ft)	24,128	25,781	25,736	25,610	26,697	26,355	25,663	26,019	26,221
Maximum Bending Moment - GET (sec)	74.7	79.4	91.5	77.5	76	76	80.1	86.5	79
Maximum Bending Moment (lbf-in)	60,000,000	86,000,000	33,200,000	37,000,000	69,000,000	116,000,000	80,000,000	71,000,000	96,000,000
Maximum q - GET (sec)	78.9	85.5	83.0	81.1	81.3	81.0	82.0	86.0	82.5
Maximum q Altitude (ft)	44,062	45,138	44,512	42,133	40,876	40,398	44,971	47,122	42,847
Maximum q (lb/ft)	776.938	630.73	735.17	682.95	651.63	655.80	768.58	726.81	701.75
S-IC Stage Burn (S-IB Apollo 7)									

33 Compiled from Saturn V launch vehicle flight evaluation reports, Apollo/Saturn V postflight trajectory reports, and mission reports.

Duration (sec)	160.41	169.06	168.03	168.2	170.3	170.6	166.1	168.5	168.1
Maximum Total Inertial Acceleration - GET (sec)	153.92	162.84	161.71	161.82	163.70	164.18	159.56	161.78	161.20
Maximum Total Inertial Acceleration - (ft/sec^2)	127.46	123.75	126.67	125.79	123.36	122.90	127.85	122.90	124.51
Maximum Total Inertial Acceleration - (g)	3.96	3.85	3.94	3.91	3.83	3.82	3.97	3.82	3.87
Maximum Earth-Fixed Velocity - GET (sec)	154.47	163.45	162.30	162.18	164.10	164.59	160.00	162.5	162.0
Maximum Earth-Fixed Velocity (ft/sec)	7,727.36	7,837.89	7,882.9	7,852.0	7,820.9	7,774.9	7,387.6	7,779.5	7,790.0
Apex - GET (sec)	266.54	266.03	269.1	275.6	271.7	271.8	277.562	270.973	273.689
Apex - Altitude (n mi)	64.69	59.23	62.1	66.4	63.1	62.9	68.8	63.1	64.9
Apex - Range (n mi)	175.70	172.37	176.8	181.4	176.0	174.5	182.9	174.8	177.2
S-II Stage Burn									
Duration (sec)	367.85	371.06	384.22	389.14	426.64	392.55	386.06	394.34	395.06
Maximum Total Inertial Acceleration - GET (sec)	524.14	536.31	460.70	460.83	537.00	463.17	459.56	461.77	461.21

Maximum Total Inertial Acceleration - (ft/sec^2)	59.71	64.34	58.53	58.79	53.31	58.10	57.58	56.00	56.00
Maximum Total Inertial Acceleration - (g)	1.86	2.00	1.82	1.83	1.66	1.81	1.79	1.74	1.74
Maximum Earth-Fixed Velocity GET (sec)	524.90	536.45	549.00	553.20	593.50	560.07	550.00	560.0	560.6
Maximum Earth-Fixed Velocity (ft/sec)	21,068.14	21,441.11	21,377.0	21,517.8	21,301.6	21,574.5	21,601.4	21,550.9	21,567.6
Apex - GET (sec)	560.34	593.58	587.0	581.7	632.2	600.2	553.225	584.122	574.527
Apex - Altitude (n mi)	104.21	102.50	101.9	103.2	103.0	102.4	95.2	93.7	93.3
Apex - Range (n mi)	934.06	1,026.36	1,005.9	985.3	1,098.8	1,032.2	888.9	978.7	946.2
S-IVB First Burn									
Duration (sec)	156.69	123.84	147.13	137.31	152.93	137.16	141.47	142.61	138.85
Maximum Total Inertial Acceleration - GET (sec)	685.08	664.74	699.41	693.99	750.00	700.66	694.67	706.21	702.65
Maximum Total Inertial Acceleration (ft/sec^2)	23.10	25.72	22.08	22.21	21.85	21.62	21.00	21.59	21.46
Maximum Total Inertial Acceleration (g)	0.72	0.80	0.69	0.69	0.68	0.67	0.65	0.67	0.67

Maximum Earth-Fixed Velocity - GET (sec)	685.50	674.66	709.33	703.91	750.50	710.56	704.67	716.21	712.70
Maximum Earth-Fixed Velocity (ft/sec)	24,244.26	24,246.39	24,243.8	24,242.3	24,243.1	24,221.8	24,242.4	24,286.1	24,231.0
S-IVB Second Burn									
Duration (sec)	317.72	62.06	346.83	341.14	350.85	350.84	350.71	341.92	351.04
Maximum Total Inertial Acceleration - GET[34]	002:55:55.61	004:46:57.68	002:50:03.11	002:53:04.02	002:41:37.23	002:34:23.34	002:55:53.61	002:39:18:42	003:18:27.64
Maximum Total Inertial Acceleration (ft/sec^2)	49.77	39.90	46.65	47.74	46.23	46.56	45.01	45.64	45.44
Maximum Total Inertial Acceleration (g)	1.55	1.24	1.45	1.48	1.44	1.45	1.40	1.42	1.41
Maximum Earth-Fixed Velocity - GET	002:55:56.00	004:46:58.20	002:50:03.50	002:53:04.32	002:41:37.80	002:34:23.67	002:55:54.00	002:39:20.0	003:18:28.5
Maximum Earth-Fixed Velocity (ft/sec)	34,178.74	26,432.58	34,230.3	34,063.0	34,231.0	34,194.9	34,236.9	34,269.0	34,202.4
S-IVB Third Burn									
Duration (sec)	---	242.06	---	---	---	---	---	---	---

34 GET is expressed as hours:minutes:seconds (hhh:mm:ss) for the S-IVB second and third burns.

Maximum Total Inertial Acceleration - GET	---	006:08:53.00	---	---	---	---	---	---	---
Maximum Total Inertial Acceleration (ft/sec^2)	---	54.40	---	---	---	---	---	---	---
Maximum Total Inertial Acceleration (g)	---	1.69	---	---	---	---	---	---	---
Maximum Earth-Fixed Velocity - GET	---	006:11:23.50	---	---	---	---	---	---	---
Maximum Earth-Fixed Velocity (ft/sec)	---	29,923.49	---	---	---	---	---	---	---

Earth Orbit Data[35]

	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Earth Orbit Insertion										
Insertion - GET (sec)	694.98	674.66	713.76	709.33	703.91	759.83	710.56	704.67	716.21	712.65
Altitude (ft)	627,819	626,777	627,869	626,909	626,360	628,710	626,364	566,387	567,371	559,348
Surface Range (n mi)	1,430.363	1,335.515	1,469.790	1,460.697	1,438.608	1,572.300	1,444.989	1,445.652	1,469.052	1,456.314
Earth Fixed Velocity (ft/sec)	24,242.9	24,246.3	24,244.3	24,243.9	24,242.3	24,242.1	24,221.6	24,242.4	24,286.1	24,230.9
Space-Fixed Velocity (ft/sec)	25,567.06	25,569.78	25,567.88	25,567.9	25,565.9	25,566.1	25,565.8	25,602.6	25,605.0	25,603.9

35 Compiled from Saturn V launch vehicle flight evaluation reports, Apollo/Saturn V postflight trajectory reports and mission reports.

Geocentric Latitude (° N)	32.4741	32.4599	32.5027	31.5128	32.5249	31.0806	29.2052	32.5262	24.5384
Geodetic Latitude (°N)	32.6487	32.6293	32.672	32.6823	32.6945	31.2460	29.3650	32.6963	24.6805
Longitude (°E)	-53.2923	-55.1658	-52.6941	-53.1311	-50.4902	-52.9826	-53.0807	-52.5300	-53.8107
Space-Fixed Flight Path Angle (°)	0.0006	-0.0058	0.012	-0.014	0.005	-0.003	0.015	0.001	0.003
Space-Fixed Heading Angle (° E of N)	88.532	87.4128	88.848	88.580	90.148	91.656	95.531	88.932	105.021
Apogee (n mi)	99.99	100.74	100.4	100.1	100.3	100.1	91.5	91.3	90.3
Perigee (n mi)	99.57	99.68	98.9	97.8	99.3	98.9	89.6	90.0	90.0
Period (mins)	88.19	88.20	88.18	88.16	88.19	88.18	87.84	87.85	87.83

Inclination (deg)	32.509	32.552 32.546	32.521	32.540	32.547	31.120	29.679	32.542	28.526
Descending Node (deg)	42.415	45.538 123.132	123.088	123.126	123.084	117.455	109.314	123.123	86.978
Eccentricity	0.00006	0.0001490.0000086	0.00021	0.00032	0.0001	0.0002	0.0003	0.0002	0.0000
Earth Orbit - Revolutions	1.5	151.01.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0
Earth Orbit Duration	002:44:30.53	240:32:55.54 002:27:26.82	002:38:23.70	002:41:30.03	002:28:27.32	002:22:42.68	002:44:18.94	002:27:32.21	003:06:44.99

Saturn Stage Earth Impact[36]

	Apollo 8	Apollo 9	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
S-IB Impact									
GET (sec)	---	---	---	---	---	---	---	---	---
Surface Range (n mi)	---	---	---	---	---	---	---	---	---
Geodetic Latitude (°N)	---	---	---	---	---	---	---	---	---
Longitude (°E)	---	---	---	---	---	---	---	---	---
S-IC Impact									

36 Theoretical impacts compiled from Saturn V launch vehicle flight evaluation reports, and Apollo/Saturn V postflight trajectory reports. Impact date is same as launch date except for S-IVB stage, as indicated.

GET (sec)	540.410	536.436	543.7	554.5	546.9	546.2	560.389	547.136	551.708
Surface Range (n mi)	353.462	346.635	357.1	365.200	355.300	351.700	368.800	351.600	356.6
Geodetic Latitude (°N)	30.2040	30.1830	30.212	30.273	30.177	29.835	29.4200	30.207	28.219
Longitude (°E)	-74.1090	-74.238	-74.038	-73.895	-74.0650	-74.0520	-73.6530	-74.147	-73.8780
S-II Impact									
GET (sec)	1,145.106	1,205.346	1,213.7	1,221.6	1,258.1	1,246.3	1,143.912	1,202.390	1,146.947
Surface Range (n mi)	2,245.913	2,413.198	2,371.8	2,404.4	2,452.600	2,462.100	2,261.3	2,312.000	2292.800

Geodetic Latitude (°N)	31.8338	31.4618	31.535	31.465	31.320	29.049	26.975	31.726	20.056
Longitude (°E)	-37.2774	-34.0408	-34.844	-34.214	-33.2890	-33.567	-37.924	-35.990	-39.6040
S-IVB Earth Impact									
GET	---	---	---	---	---	---	---	---	---
KSC Date	---	---	---	---	---	---	---	---	---

GMT Date	---	---	---	---	---	---	---	---	---
KSC Time	---	---	---	---	---	---	---	---	---
Time Zone	---	---	---	---	---	---	---	---	---
GMT Time	---	---	---	---	---	---	---	---	---
Latitude (°N)	---	---	---	---	---	---	---	---	---

Longitude (°E)	---	---	---	---	---	---	---	---	---

Launch Vehicle Propellant Usage[37]

	Apollo 7	Apollo 7 Apollo 7	Apollo 8	Apollo 8	Apollo 8	Apollo 8	Apollo 9	Apollo 9	Apollo 9	Apollo 9	Apollo 10	Apollo 10	Apollo 10	Apollo 10
	Burn End	Burn Time	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)
S-IB Burn (sec)	144.32	147.31	---	---	---	---	---	---	---	---	---	---	---	---
Oxidizer (LOX), lb	3,231	628,069	---	---	---	---	---	---	---	---	---	---	---	---
Fuel (RP-1), lb	4,728	272,172	---	---	---	---	---	---	---	---	---	---	---	---
Total, lb	7,959	900,241	---	---	---	---	---	---	---	---	---	---	---	---

37 All burn start and burn end times are referenced to Range Zero; all other values represent actual usage, in pounds mass. Sources are the Saturn V launch vehicle flight evaluation reports and *Results of the Fifth Saturn IB Vehicle Test Flight (Apollo 7).*

		11.3												
S-IC Burn (sec)	---	---	-6.585	153.82	160.41	---	-6.3	162.76	169.06	---	-6.4	161.63	168.03	---
Oxidizer (LOX), lb	---	---	3,128,034	46,065	3,081,969	19,213.7	3,301,203	45,230	3,255,973	19,259.3	3,302,827	40,592	3,262,235	19,414.6
Fuel (RP-1)	---	---	1,357,634	26,622	1,331,012	8,297.8	1,431,678	42,390	1,389,288	8,217.7	1,423,254	28,537	1,394,717	8,300.4
Total, lb	---	---	4,485,668	72,687	4,412,981	27,511.5	4,732,881	87,620	4,645,261	27,477.0	4,726,081	69,129	4,656,952	27,715.0
S-II Burn (sec)	---	---	156.19	524.04	367.85	---	165.16	536.22	371.06	---	164.05	552.64	388.59	388.59
Oxidizer (LOX), lb	---	---	793,795	5,169	788,626	2,143.9	821,504	3,230	818,274	2,205.2	823,325	3,536	819,789	2,109.7
Fuel (LH_2), lb	---	---	154,907	4,514	150,393	408.8	158,663	3,381	155,282	418.5	158,541	4,622	153,919	396.1
Total, lb	---	---	948,702	9,683	939,019	2,552.7	980,167	6,611	973,556	2,623.7	981,866	8,158	973,708	2,505.7
S-IVB 1st Burn (sec)	616.76	469.79	528.29	684.98	156.69	---	540.82	664.66	123.84	---	556.81	703.76	146.95	---
Oxidizer (LOX), lb	1,671	191,659	192,840	132,220	60,620	386.9	189,686	133,421	56,265	454.3	192,089	133,883	58,206	396.1
Fuel (LH_2), lb	2,502	37,407	43,395	30,678	12,717	81.2	43,709	32,999	10,710	86.5	43,388	31,564	11,824	80.5
		408.0												
		79.6												

Total, lb	4,173	229,066.6	487	236,235	162,898	73,337	468.0	233,395	166,420	66,975	540.8	235,477	165,447	70,030	476.6
S-IVB 2nd Burn (sec)	---	---	---	10,237.79	10,555.51	317.72	---	17,155.54	17,217.60	62.06	---	9,207.52	9,550.58	343.06	343.06
Oxidizer (LOX), lb	---	---	---	131,975	8,064	123,911	390.0	132,988	109,298	23,690	381.7	133,471	5,274	128,197	373.7
Fuel (LH_2), lb	---	---	---	28,358	2,759	25,599	80.6	29,369	24,476	4,893	78.8	29,116	2,177	26,939	78.5
Total, lb	---	---	---	160,333	10,823	149,510	470.6	162,357	133,774	28,583	460.6	162,587	7,451	155,136	452.2
S-IVB 3rd Burn (sec)	---	---	---	---	---	---	---	22,039.26	22,281.32	242.06	---	---	---	---	---
Oxidizer (LOX), lb	---	---	---	---	---	---	---	108,927	34,051	74,876	309.3	---	---	---	---
Fuel (LH_2), lb	---	---	---	---	---	---	---	23,520	8,951	14,569	60.2	---	---	---	---
Total, lb	---	---	---	---	---	---	---	132,447	43,002	89,445	369.5	---	---	---	---
Oxidizer-Fuel Ratio															
S-IB Stage	---	2.308	---	---	---	---	---	---	---	---	---	---	---	---	---
S-IC Stage	---	---	---	2.304	---	2.316	---	2.306	---	2.344	---	2.321	---	2.339	---
S-II Stage	---	---	---	5.124	---	5.244	---	5.178	---	5.270	---	5.193	---	5.326	---
S-IVB Stage 1st burn	---	5.124	---	4.444	---	4.767	---	4.340	---	5.254	---	4.427	---	4.923	---
S-IVB Stage 2nd burn	---	---	-	4.654	---	4.840	---	4.528	---	4.842	---	4.584	---	4.759	---

S-IVB Stage 3rd burn	---	---	---	---	---	---	---	4.631	---	5.139	---	---	---	---	---	---

Launch Vehicle Propellant Usage[38]

	Apollo 11	Apollo 11	Apollo 11	Apollo 11	Apollo 12	Apollo 12	Apollo 12	Apollo 12	Apollo 13	Apollo 13	Apollo 13	Apollo 13	Apollo 14	Apollo 14	Apollo 14	Apollo 14
	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)
S-IC Burn (sec)	-6.4	161.63	168.03	---	-6.5	161.74	168.24	---	-6.7	163.60	170.30	---	-6.5	164.10	170.60	---
Oxidizer (LOX), lb	3,305,786	39,772	3,266,014	19,437.1	3,310,199	42,093	3,268,106	19,425.3	3,304,734	38,921	3,265,813	19,176.8	3,312,769	42,570	3,270,199	19,168.8
Fuel (RP-1), lb	1,424,889	30,763	1,394,126	8,296.9	1,424,287	36,309	1,387,978	8,250.0	1,431,384	27,573	1,403,811	8,243.2	1,428,561	32,312	1,396,249	8,184.3
Total, lb	4,730,675	70,535	4,660,140	27,734.0	4,734,486	78,402	4,656,084	27,675.2	4,736,118	66,494	4,669,624	27,420.0	4,741,330	74,882	4,666,448	27,353.2
S-II Burn (sec)	164.00	548.22	384.22	---	163.20	552.34	389.14	---	166.00	592.64	426.64	---	166.50	559.05	392.55	---
Oxidizer (LOX), lb	819,050	3,536	815,514	2,122.5	825,406	3,536	821,870	2,112.0	836,741	3,533	833,208	1,953.0	837,484	2,949	834,535	2,125.9
Fuel (LH_2), lb	158,116	10,818	147,298	383.4	157,986	4,610	153,376	394.1	159,931	4,532	155,399	364.2	159,232	3,232	156,000	397.4
Total, lb	977,166	14,354	962,812	2,505.9	983,392	8,146	975,246	2,506.2	996,672	8,065	988,607	2,317.2	996,716	6,181	990,535	2,523.3
S-IVB 1st Burn (sec)	552.20	699.33	147.13	---	556.60	693.91	137.31	---	596.90	749.83	152.93	---	563.40	700.56	137.16	---
Oxidizer (LOX), lb	192,497	135,144	57,353	389.8	190,587	135,909	54,678	398.2	191,890	132,768	59,122	386.6	190,473	136,815	53,658	391.2
Fuel (LH_2), lb	43,608	31,736	11,872	80.7	43,663	32,346	11,317	82.4	43,657	31,455	12,202	79.8	43,546	32,605	10,941	79.8
Total, lb	236,105	166,880	69,225	470.5	234,250	168,255	65,995	480.6	235,547	164,223	71,324	466.4	234,019	169,420	64,599	471.0
S-IVB 2nd Burn (sec)	9,856.20	10,203.03	346.83	---	10,042.80	10,383.94	341.14	---	9,346.30	9,697.15	350.85	---	8,912.40	9,263.24	350.84	---
Oxidizer (LOX), lb	134,817	5,350	129,467	373.3	135,617	4,659	130,958	383.9	132,525	3,832	128,693	366.8	136,551	5,812	130,739	372.6
Fuel (LH_2), lb	29,324	2,112	27,212	78.5	29,804	2,109	27,695	81.2	29,367	1,963	27,404	78.1	30,428	2,672	27,756	79.1
Total, lb	164,141	7,462	156,679	451.7	165,421	6,768	158,653	465.1	161,892	5,795	156,097	444.9	166,979	8,484	158,495	451.8
Oxidizer-Fuel Ratio																
S-IC Stage	2.320	---	2.343	---	2.324	---	2.355	---	2.309	---	2.326	---	2.319	---	2.342	---
S-II Stage	5.180	---	5.536	---	5.225	---	5.359	---	5.232	---	5.362	---	5.260	---	5.350	---
S-IVB Stage 1st burn	4.414	---	4.831	---	4.365	---	4.831	---	4.395	---	4.845	---	4.374	---	4.904	---
S-IVB Stage 2nd burn	4.597	---	4.75	---	4.550	---	4.729	---	4.513	---	4.696	---	4.488	---	4.710	---

38 All burn start and burn end times are referenced to Range Zero; all other values represent actual usage, in pounds mass. Sources are the Saturn V launch vehicle flight evaluation reports.

Launch Vehicle Propellant Usage[39]

	Apollo 15	Apollo 15	Apollo 15	Apollo 15	Apollo 16	Apollo 16	Apollo 16	Apollo 16	Apollo 17	Apollo 17	Apollo 17	Apollo 17	Program Totals	Program Totals	Program Totals	Program Totals
	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)	Burn Start	Burn End	Burn Time	Burn Rate (lb/sec)
S-IC Burn (sec)	-6.5	159.56	166.06	---	-6.7	161.78	168.48	---	-6.9	161.20	168.10	---	---	---	1,677.31	---
Oxidizer (LOX), lb	3,312,030	31,135	3,280,895	19,757.3	3,311,226	34,028	3,277,198	19,451.6	3,314,388	36,479	3,277,909	19,499.8	32,903,196	396,885	32,506,311	19,380.1
Fuel (RP-1), lb	1,410,798	27,142	1,383,656	8,332.3	1,439,894	31,601	1,408,293	8,358.8	1,431,921	26,305	1,405,616	8,361.8	14,204,300	309,554	13,894,746	8,284.0
Total, lb	4,722,828	58,277	4,664,551	28,089.6	4,751,120	65,629	4,685,491	27,810.4	4,746,309	62,784	4,683,525	27,861.5	47,107,496	706,439	46,401,057	27,664.1
S-II Burn (sec)	163.00	549.06	386.06	---	165.20	559.54	394.34	---	164.60	559.66	395.06	---	---	---	3,895.51	---
Oxidizer (LOX), lb	837,991	3,109	834,882	2,162.6	846,157	3,141	843,016	2,137.8	844,094	3,137	840,957	2,128.7	8,285,547	34,876	8,250,671	2,118.0
Fuel (LH_2), lb	158,966	4,022	154,944	401.3	160,551	2,884	157,667	399.8	160,451	3,024	157,427	398.5	1,587,344	45,639	1,541,705	395.8
Total, lb	996,957	7,131	989,826	2,563.9	1,006,708	6,025	1,000,683	2,537.6	1,004,545	6,161	998,384	2,527.2	9,872,891	80,515	9,792,376	2,513.8
S-IVB 1st Burn (sec)	553.20	694.67	141.47	---	563.60	706.21	142.61	---	563.80	702.65	138.85	---	---	---	1,424.94	---
Oxidizer (LOX), lb	195,788	140,293	55,495	392.3	195,372	138,937	56,435	395.7	195,636	140,047	55,589	400.4	1,926,858	1,359,437	567,421	398.2
Fuel (LH_2), lb	43,674	32,416	11,258	79.6	43,727	32,081	11,646	81.7	43,752	32,685	11,067	79.7	436,119	320,565	115,554	81.1
Total, lb	239,462	172,709	66,753	471.9	239,099	171,018	68,081	477.4	239,388	172,732	66,656	480.1	2,362,977	1,680,002	682,975	479.3
S-IVB 2nd Burn (sec)	10,202.90	10,553.61	350.71	---	9,216.50	9,558.42	341.92	---	11,556.60	11,907.64	351.04	---	---	---	3,156.17	---
Oxidizer (LOX), lb	139,665	4,273	135,392	386.1	138,532	3,869	134,663	393.8	139,879	4,219	135,660	386.5	1,356,020	154,650	1,201,370	380.6
Fuel (LH_2), lb	29,799	1,722	28,077	80.1	29,968	2,190	27,778	81.2	30,050	2,212	27,838	79.3	295,583	44,392	251,191	79.6
Total, lb	169,464	5,995	163,469	466.1	168,500	6,059	162,441	475.1	169,929	6,431	163,498	465.8	1,651,603	199,042	1,452,561	460.2
Oxidizer-Fuel Ratio																
S-IC Stage	2.348	---	2.371	---	2.300	---	2.327	---	2.315	---	2.332	---	2.316	---	2.339	---
S-II Stage	5.272	---	5.388	---	5.270	---	5.347	---	5.261	---	5.342	---	5.220	---	5.352	---
S-IVB Stage 1st burn	4.483	---	4.929	---	4.468	---	4.846	---	4.471	---	5.023	---	4.418	---	4.910	---
S-IVB Stage 2nd burn	4.687	---	4.822	---	4.623	---	4.848	---	4.655	---	4.873	---	4.588	---	4.783	---

39 All burn start and burn end times are referenced to Range Zero; all other values represent actual usage, in pounds mass. Sources are the Saturn V launch vehicle flight evaluation reports.

Translunar Injection[40]

	Apollo 8	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
GET	002:56:05.51	002:39:20.58	002:50:13.03	002:53:13.94	002:41:47.15	002:34:33.24	002:56:03.61	002:39:28.42	003:18:37.64
KSC Date	21 Dec 1968	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
GMT Date	21 Dec 1968	18 May 1969	16 Jul 1969	14 Nov 1969	11 Apr 1970	31 Jan 1971	26 Jul 1971	16 Apr 1972	07 Dec 1972
KSC Time	10:47:05 a.m.	03:28:20 p.m.	12:22:13 p.m.	02:15:13 p.m.	04:54:47 p.m.	06:37:35 p.m.	12:30:03 p.m.	03:33:28 p.m.	03:51:37 a.m.
Time Zone	EST	EDT	EDT	EST	EST	EST	EDT	EST	EST
GMT Time	15:47:05	19:28:20	16:22:13	19:15:13	21:54:47	23:37:35	16:30:03	20:33:28	08:51:37
Altitude (ft)	1,137,577	1,093,217	1,097,229	1,209,284	1,108,555	1,090,930	1,055,296	1,040,493	1,029,299
Altitude (n mi)	187.221	179.920	180.581	199.023	182.445	179.544	173.679	171.243	169.401
Earth Fixed Velocity (ft/sec)	34,140.1	34,217.2	34,195.6	34,020.5	34,195.3	34,151.5	34,202.2	34,236.6	34,168.3
Space-Fixed Velocity (ft/sec)	35,505.41	35,562.96	35,545.6	35,389.8	35,538.4	35,511.6	35,579.1	35,566.1	35,555.3
Geocentric Latitude (°N)	21.3460	-13.5435	9.9204	16.0791	-3.8635	-19.4388	24.8341	-11.9117	4.6824
Geodetic Latitude (°N)	21.477	-13.627	9.983	16.176	-3.8602	-19.554	24.9700	-11.9881	4.7100
Longitude (deg E)	-143.9242	159.9201	-164.8373	-154.2798	167.2074	141.7312	-142.1295	162.4820	-53.1190
Flight Path Angle (°)[41]	7.897	7.379	7.367	8.584	7.635	7.480	7.430	7.461	7.379
Heading Angle (° E of N)	67.494	61.065	60.073	63.902	59.318	65.583	73.173	59.524	118.110
Inclination (°)	30.636	31.698	31.383	30.555	31.817	30.834	29.696	32.511	28.466
Descending Node (°)	38.983	123.515	121.847	120.388	122.997	117.394	108.439	122.463	86.042
Eccentricity	0.97553	0.97834	0.97696	0.96966	0.9772	0.9722	0.9760	0.9741	0.9722
C3 (ft^2/sec^2)	-15,918,930	-14,084,265	-14,979,133	-19,745,586	-14,814,090	-18,096,135	-15,643,934	-16,881,439	-18,152,226

40 Compiled from Saturn V launch vehicle flight evaluation reports and mission reports.

41 Flight path angle and heading angle are 'space-fixed' for these measurements.

S-IVB Solar Trajectory[42]

	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12
S-IVB Closest Approach To Moon					
GET	069:58:55.2	---	078:51:03.6	078:42	085:48
KSC Date	24 Dec 1968	---	21 May 1969	19 Jul 1969	18 Nov 1969
GMT Date	24 Dec 1968	---	21 May 1969	19 Jul 1969	18 Nov 1969
KSC Time	05:49:55 a.m.	---	07:40 p.m.	04:14 p.m.	01:10 a.m.
KSC Time Zone	EST	---	EDT	EDT	EST
GMT Time	10:49:55	---	23:40	20:14	06:10
Lunar Radius of Closest Approach (n mi)	1,620	---	2,619	2,763	4,020
Altitude Above Lunar Surface (n mi)	682	---	1,680	1,825	3,082
Velocity Increase Due To Lunar Gravity (n mi/sec)	0.79	---	0.459	0.367	0.296
S-IVB Solar Orbit Conditions					
Semi-Major Axis (n mi)	77,130,000	74,848,893	77,740,000	77,260,000	---
Eccentricity	---	0.07256	---	---	---
Aphelion (n mi)	79,770,000	80,280,052	82,160,000	82,000,000	---
Perihelion (n mi)	74,490,000	69,417,732	73,330,000	72,520,000	---
Inclination (deg)	23.47	24,390	23.46	0.3836[2]	---
Period (days)	340.8	325.8	344.88	342	---

42 Compiled from Saturn V launch vehicle flight evaluation reports.

S-IVB Lunar Impact[43]

	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
S-IVB Lunar Impact					
GET	077:56:40.0	082:37:53.4	079:24:42.9	075:08:04	086:59:42.3
KSC Date	14 Apr 1970	04 Feb 1971	29 Jul 1971	19 Apr 1972	10 Dec 1972
GMT Date	15 Apr 1970	04 Feb 1971	29 Jul 1971	19 Apr 1972	10 Dec 1972
KSC Time	08:09:40 p.m.	02:40:55 a.m.	04:58:42 p.m.	04:02:04 p.m.	03:32:42 p.m.
Time Zone	EST	EST	EDT	EST	EST
GMT Time	01:09:40.0	07:40:55.4	20:58:42.9	21:02:04	20:32:42.3
Weight (lbm)	29,599	30,836	30,880	30,805	30,712
Velocity (ft/sec)	8,465	8,333	8,465	8,202	8,366
Energy (ergs)	4.63×10^{17}	4.52×10^{17}	4.61×10^{17}	4.59×10^{17}	4.71×10^{17}
Angle From Horizontal (°)	76	69	62	~79	55
Heading Angle (° N to W)	100.6	75.7	83.46	104.7	83
S-IVB Lunar Impact -Tumble Rate (deg/sec)	12	1	1	---	---
Selenocentric Latitude (°N)	-2.75	-8.09	-1.51	1.3	-4.21
Selenocentric Longitude (°E)	-27.86	-26.02	-11.81	-23.8	-12.31
Crater Diameter (calculated) (ft)	134.8	133.9	134.8	---	---
Crater Diameter (measured) (ft)	135.0	129.6	---	---	---
Distance To Target (n mi)	35.4	159	83	173	84
Distance To Seismic Stations (n mi)					
Apollo 12	73	93	192	71	183
Apollo 14	---	---	99	131	85
Apollo 15	---	---	---	593	557
Apollo 16	---	---	---	---	459
Azimuth To Seismic Stations (deg)					
Apollo 12	274	207	083	355	096
Apollo 14	---	---	069	308	096
Apollo 15	---	---	---	231	209
Apollo 16	---	---	---	---	278

43 Compiled from Saturn V launch vehicle flight evaluation reports, Apollo mission preliminary science reports, and mission reports. Apollo 16 data based on seismic data due to loss of S-IVB tracking prior to impact; impact time is +/- 4 seconds; impact site is +/-0.7° latitude and +/- 0.3° longitude. Impact times for all vehicles are when impact signal was received on Earth.

LM Lunar Landing[44]

	Apollo 10[45]	Apollo 11	Apollo 12	Apollo 13[46]	Apollo 14	Apollo 15	Apollo 16	Apollo 17
LM Lunar Landing Conditions								
PDI Burn Duration (sec)	---	756.39	717.0	---	764.61	739.2	734	721
Hover Time Remaining (sec)	---	45	103	---	68	103	102	117
Landing Site	Sea of Tranquility	Sea of Tranquility	Ocean of Storms	Fra Mauro	Fra Mauro	Hadley-Apennine	Plain of Descartes	Taurus-Littrow
Targeted Latitude (°N)	0.7333	0.6833	-2.9833	-3.6167	-3.6719	26.0816	-9.0002	20.1639
Targeted Longitude (°E)	23.6500	23.7167	-23.4000	-17.5500	-17.4627	3.6583	15.5164	30.7495
Actual Landing Latitude (°N)	---	0.67416	-3.0128	---	-3.64589	26.13239	-8.9734	20.1911
Actual Landing Longitude (°E)	---	23.47314	-23.4219	---	-17.47194	3.63330	15.5011	30.7723
GET	---	102:45:39.9	110:32:36.2	---	108:15:11.40	104:42:29.3	104:29:35	110:21:58
KSC Date		20 Jul 1969	19 Nov 1969		05 Feb 1971	30 Jul 1971	20 Apr 1972	11 Dec 1972
GMT Date		20 Jul 1969	19 Nov 1969		05 Feb 1971	30 Jul 1971	21 Apr 1972	11 Dec 1972
KSC Time	---	04:17:39 p.m.	01:54:36 a.m.	---	04:18:13 a.m.	06:16:29 p.m.	09:23:35 p.m.	02:54:58 p.m.
Time Zone	---	EDT	EST	---	EST	EDT	EST	EST
GMT Time	---	20:17:39	06:54:36	---	09:18:13	22:16:29	02:23:35	19:54:58
Sun Angle (deg)	11.0	10.8	5.1	18.5	10.3	12.2	11.9	13.0
LM Surface Angle (deg)	---	4.5° tilt east; yaw 13° south	3° pitch up, 3.8° roll left	---	1° pitch down; 6.9° roll right; 1.4° yaw left	6.9° pitch up; 8.6° roll left resulting in tilt of 11° from horizontal	0° roll, 2.5° pitch up, slight yaw south	4 to 5° pitch up, 0° roll, near 0° yaw
LM Distance To Target (ft)		22,500 ft W of landing ellipse center	535 ft NW of Surveyor III	---	55 ft N; 165 ft E	1,800 ft NW	668 ft N; 197 ft W	656 ft
Distance To Seismic Stations (n mi)								
Apollo 12		---	---	---	98	641	641	---
Apollo 14		---	98	---	---	591	544	---
Apollo 15		---	641	---	591	---	604	---
Apollo 16		---	641	---	544	604	---	---
Azimuth To Seismic Stations (deg)								
Apollo 12		---	---	---	96	40	100	---
Apollo 14		---	276	---	---	33	101	---
Apollo 15		---	226	---	218	---	160	---
Apollo 16		---	276	---	277	342	---	---

44 Compiled from mission reports and summary science reports. Actual landing site coordinates based on planetocentric Mean Earth/Polar Axis Lunar Reference System, DE421 ephemeris, determined from Lunar Reconnaissance Orbiter images (see Wagner et al., Icarus 283, pages 92-103 (2017).

45 Although not planned as a lunar landing mission, Apollo 10 flew over the area to be targeted by the first lunar landing mission.

46 Data is for intended landing site; mission aborted.

LM Descent Stage Propellant Status[47]

Weight (lbm)	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Loaded									
Fuel	6,977	7,009.5	6,975	7,079	7,083.6	7,072.8	7,537.6	7,530.4	7,521.7
Oxidizer	11,063	11,209.2	11,209	11,350	11,350.9	11,344.4	12,023.9	12,028.9	12,042.5
Total	18,040	18,218.7	18,184	18,429	18,434.5	18,417.2	19,561.5	19,559.3	19,564.2
Consumed									
Fuel	4,127	295.0	6,724	6,658	3,225.5	6,812.8	7,058.3	7,105.4	7,041.3
Oxidizer	6,524	470.0	10,690	10,596	5,117.4	10,810.4	11,315.0	11,221.9	11,207.6
Total	10,651	765.0	17,414	17,254	8,342.9	17,623.2	18,373.3	18,327.3	18,248.9
Remaining at Cutoff									
Fuel	---	---	251	421	---	260.0	479	425	480.0
Oxidizer	---	---	519	754	---	534.0	709	807	835.0
Total	---	---	770	1,175	---	794.0	1,188	1,232	1,315.0
Usable at Cutoff									
Fuel	---	---	216	386	---	228.0	433	396	455.0
Oxidizer	---	---	458	693	---	400.0	622	732	770.0
Total			674	1,079	---	628.0	1,055	1,128	1,225.0
Remaining at Cutoff (No Landing)									

47 Compiled from mission reports.

Fuel	2,850	6,714.5	---	---	3,858.1	---	---	---	---
Oxidizer	4,539	10,739.2	---	---	6,233.5	---	---	---	---
Total	7,389	17,453.7	---	---	10,091.6	---	---	---	---

LM Ascent Stage Propellant Status[48]

Weight (lbm)	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Loaded								
Fuel	1,626	981	2,020	2,012	2,007.0	2,011.4	2,017.8	2,026.9
Oxidizer	2,524	1,650	3,218	3,224	3,218.2	3,225.6	3,224.7	3,234.8
Total	4,150	2,631	5,238	5,236	5,225.2	5,237.0	5,242.5	5,261.7
Transferred from RCS								
Fuel	---	---	---	---	---	---	16.0	---
Oxidizer	---	---	---	---	---	---	44.0	---
Total	---	---	---	---	---	---	60.0	---
Consumed by RCS								
Fuel	22	13.9	23	31	---	---	---	---
Oxidizer	44	28.0	46	62	---	---	---	---
Total	66	41.9	69	93	---	---	---	---
Consumed by APS Prior to Jettison								
Fuel	31	67	1,833	1,831	---	---	---	---
Oxidizer	59	108	2,934	2,943	---	---	---	---
Total	90	175	4,767	4,774	---	---	---	---
Remaining at Jettison								
Fuel	---	---	164	150	128.0	118.0	164.0	108.9
Oxidizer	---	---	238	219	204.2	173.0	257.7	175.6
Total	---	---	402	369	332.2	291.0	421.7	284.5
Consumed at Fuel Depletion								
Fuel	---	13	---	---	---	---	---	---
Oxidizer	---	106	---	---	---	---	---	---
Total	---	119	---	---	---	---	---	---
Consumed at Oxidizer Depletion								
Fuel	68	---	---	---	---	---	---	---
Oxidizer	0	---	---	---	---	---	---	---
Total	68	---	---	---	---	---	---	---
Total Consumed								
Fuel	1,558	887	1,856	1,862	1,879.0	1,893.4	1,869.8	1,918.0
Oxidizer	2,524	1,408	2,980	3,005	3,014.0	3,052.6	3,011.0	3,059.2
Total	4,082	2,295	4,836	4,867	4,893.0	4,946.0	4,880.8	4,977.2

48 Compiled from mission reports.

LM Ascent and Ascent Stage Lunar Impact[49]

	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16[50]	Apollo 17
LM Ascent						
GET	124:22:00.79	142:03:47.78	141:45:40	171:37:23.2	175:31:47.9	185:21:37
KSC Date	21 Jul 1969	20 Nov 1969	06 Feb 1971	02 Aug 1971	23 Apr 1972	14 Dec 1972
GMT Date	21 Jul 1969	20 Nov 1969	06 Feb 1971	02 Aug 1971	24 Apr 1972	14 Dec 1972
KSC Time	01:54:00 p.m.	09:25:47 a.m.	01:48:42 p.m.	01:11:23 p.m.	08:25:47 p.m.	05:54:37 p.m.
KSC Time Zone	EDT	EST	EST	EDT	EST	EST
GMT Time	17:54:00	14:25:47	18:48:42	17:11:23	01:25:47	22:54:37
LM Ascent Stage Lunar Impact						
GET	---	149:55:17.7	147:42:23.7	181:29:37.0	---	193:17:20.8
KSC Date	---	20 Nov 1969	06 Feb 1971	02 Aug 1971	---	15 Dec 1972
GMT Date	---	20 Nov 1969	07 Feb 1971	03 Aug 1971	---	15 Dec 1972
KSC Time	---	05:17:17 p.m.	07:45:25 p.m.	11:03:37 p.m.	---	01:50:20 a.m.
Time Zone	---	EST	EST	EDT	---	EST
GMT Time	---	22:17:17.7	00:45:25.7	03:03:37.0	---	06:50:20.8
Selenocentric Latitude (°N)	---	-3.94	-3.42	26.36	---	19.96
Selenocentric Longitude (°E)	---	-21.20	-19.67	0.25	---	30.50
Selenocentric Latitude	---	3° 56’ 24” S	3° 25’ 12” S	26° 21’ 21” N	---	19° 57’ 58” N
Selenocentric Longitude	---	21° 12’ 00” W	19° 40’ 01” W	0° 15’ 00” E	---	30° 29’ 23” E
Velocity (ft/sec)	---	5,512	5,512	5,577	---	5,479
Mass (lbm)	---	5,254	5,077	5,258	---	4,982
LM Ascent Stage Lunar Impact Energy (ergs)	---	3.36×10^{16}	3.25×10^{16}	3.44×10^{16}	---	3.15×10^{16}
Angle From Horizontal (deg)	---	3.7	3.6	3.2	---	4.9
Heading Angle (deg)	---	305.85	282	284	---	283
Crater Diameter (calculated) (ft)	---	29.9	29.6	30.2	---	---
Distance To Target (n mi)	---	35	7	12	---	0.7
Distance to LM Descent Stage Landing Site (n mi)	---	41.0	36	50	---	4.7
Distance to Seismic Stations (n mi)						
Apollo 12	---	39	62	610	---	945
Apollo 14	---	---	36	566	---	863
Apollo 15	---	---	---	50	---	416
Apollo 16	---	---	---	---	---	532

49 Compiled from Saturn V launch vehicle flight evaluation report and mission report for each flight. Times are when signals received on Earth. Actual landing site coordinates based on International Astronomical Union (IAU) Mean Earth Polar Axis coordinate system as described in the Journal of Geophysical Research, vol. 105, pages 20,227 to 20,280, 2000.

50 Deorbit maneuver was not possible and LM ascent stage remained in lunar orbit for about one year. No impact information is available.

Azimuth to Seismic Stations (deg)						
Apollo 12	---	112	096	036	---	064
Apollo 14	---	---	276	029	---	061
Apollo 15	---	---	---	276	---	098
Apollo 16	---	---	---	---	---	027

Extravehicular Activity[51]

		Apollo 9	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Earth Orbit EVA	1st EVA Participant	Scott	---	---	---	---	---	---
	1st EVA Duration	01:01	---	---	---	---	---	---
	2nd EVA Participant	Schweickart	---	---	---	---	---	---
	2nd EVA Duration	01:07:00	---	---	---	---	---	---
	2nd EVA Duration Outside LM	00:47:01	---	---	---	---	---	---
LM Stand-Up EVA	Participant					Scott		
	Duration					00:33:07		
First Surface EVA	Duration	---	02:31:40	03:56:03	04:47:50	06:32:42	07:11:02	07:11:53
	Total Distance Traveled	---	~3,300 ft	~3,300 ft	~3,300 ft	5.6 n mi	2.3 n mi	1.8 n mi
	LRV Ride Time	---	---	---	---	01:02	00:43	00:33
	LRV Park Time	---	---	---	---	01:14	03:39	---
	Total LRV Time	---	---	---	---	02:16	04:22	---
	Samples Collected (lbm)[52]	---	47.51	36.82	45.19	31.97	65.92	31.53
Second Surface EVA	Duration	---	---	03:49:15	04:34:41	07:12:14	07:23:09	07:36:56
	Total Distance Traveled	---	---	~4,300 ft	~9,800 ft	6.7 n mi	6.1 n mi	11.0 n mi
	LRV Ride Time	---	---	---	---	01:23	01:31	02:25
	LRV Park Time	---	---	---	---	02:34	03:56	---
	Total LRV Time	---	---	---	---	03:57	05:27	---
	Samples Collected (lbm)	---	---	38.80	49.16	76.94	63.93	75.18
Third Surface EVA	Duration	---	---	---	---	04:49:50	05:40:03	07:15:08
	Total Distance Traveled	---	---	---	---	2.7 n mi	6.2 n mi	6.5 n mi
	LRV Ride Time,	---	---	---	---	00:35	01:12	01:31
	LRV Park Time	---	---	---	---	01:22	02:26	---
	Total LRV Time	---	---	---	---	01:57	03:38	---
	Samples Collected (lbm)	---	---	---	---	60.19	78.04	136.69
Total Lunar Surface EVA	Total Duration	---	02:31:40	07:45:18	09:22:31	18:34:46	20:14:14	22:03:57
	Total Distance Traveled	---	~3,300 ft	~7,600 ft	~13,000 ft	15.1 n mi	14.5 n mi	19.3 n mi
	Total Samples Collected (lbm)	---	47.51	75.73	93.21	170.44	211.00	243.65
	Total LRV Ride Time	---	---	---	---	3:00	03:26	04:29
	Total LRV Park Time	---	---	---	---	05:10	10:01	---
	Total LRV Time	---	---	---	---	08:10	13:27	---
	Maximum Distance Traveled From LM (ft)	---	200[53]	1,350[54]	4,770[55]	16,470	15,092[56]	25,029
Transearth EVA	Participant	---	---	---	---	Worden	Mattingly	Evans
	Duration	---	---	---	---	00:39:07	01:23:42	01:05:44

51 Durations for lunar surface EVAs are outside LM. Other lunar EVAs are based upon "start" and "stop" times quoted in the mission reports. Apollo 9 EVAs are depressurization to repressurization.

52 Returned sample weights provided by Lunar Sample Curator, NASA Johnson Space Center.

53 *Apollo 11 Preliminary Science Report* (SP-214), p. 44.

54 *Apollo 12 Preliminary Science Report*, p. 26 (measured from map).

55 *Skylab: A Chronology* (SP-4011), pages 420-421 for Apollo 14, Apollo 15 and Apollo 17.

56 Measured from map in *Apollo 16 Preliminary Science Report* (SP-315).

Lunar Surface Experiments Package Arrays and Status[57]

Experiment	Principal Investigator	Apollo 11	Apollo 12	Apollo 15	Apollo 16	Apollo 17
Array		EASEP	ALSEP A	ALSEP A-2	ALSEP D	ALSEP E
Deploy Site Latitude (°N)		0.6735	-3.0098	26.13406	-8.9759	20.1923
Deploy Site Longitude (°E)		23.4730	-23.4249	3.62991	15.4986	30.7655
Design Life (days)		14	365	365	365	730
Uplink Frequency (MHz)		2119.0	2119.0	2119.0	2119.0	2119.0

57 *Apollo Lunar Surface Experiments Package (ALSEP): Five Years of Lunar Science and Still Going Strong*, Bendix Aerospace. Coordinates based on the planetocentric Mean Earth/Polar Axis Lunar Reference System, DE421 ephemeris, Lunar Reconnaissance Orbiter images (see Wagner et al., Icarus 283, pages 92-103 (2017). Command dates and times and uplink/downlink frequencies provided by National Space Science Data Center (NSSDC) at the Goddard Space Flight Center (all other missions). Apollo 11 central station no longer accepted commands as of 27 Aug 1969. Operational support for the ALSEP program was discontinued on 30 September 1977, per the *ALSEP Termination Report*, April 1979, NASA Reference Publication 1026.

Downlink Frequency (MHz)		2276.5	2278.5	2278.0	2276.0	2275.5
Date Commanded On		21 Jul 1969	19 Nov 1969	31 Jul 1971	21 Apr 1972	12 Dec 1972
Time Commanded On		04:40:39 GMT	14:21 GMT	18:37 GMT	19:38 GMT	02:53 GMT
Date Commanded Off		27 Aug 1969	30 Sep 1977	30 Sep 1977	30 Sep 1977	30 Sep 1977
Passive Seismic Experiment	Gary Latham, University of Texas	X	X	X	X	

Laser Ranging Retroreflector	J. E. Faller, Wesleyan University	100 corner		300 corner		
Deploy Site Latitude (°N)		0.67345		26.13341		
Deploy Site Longitude (°E)		23.47307		3.62850		
Lunar Surface Magnetometer	Palmer Dyal, Ames Research Center Charles Sonett, University of Arizona		Commanded off 14 Jun 1974	Commanded off 14 Jun 1974		
Solar Wind Composition (Exposure)	Conway W. Snyder, Jet Propulsion Laboratory	1 hr 17 min[58]	18 hr 42 min	41 hr 8 min	45 hr 5 min	
Suprathermal Ion Detector Experiment	John Freeman, Rice University		X	X		
Heat Flow Experiment	Mark Langseth, Lamont-Doherty Geological Observatory, Columbia University			X	X	X
Charged Particle Lunar Environment Experiment	D. Reasoner, Rice University					

58 *Apollo Program Summary Report* (JSC-09423), p. 3-54.

Cold Cathode Ion Gauge Experiment	Francis Johnson, University of Texas		X	X			
Active Seismic Experiment	Robert Kovach, Stanford University				X		
Lunar Seismic Profiling Experiment	Robert Kovach, Stanford University						X
Lunar Surface Gravimeter	Joseph Weber, University of Maryland						X
Lunar Mass Spectrometer	John H. Hoffman, University of Texas						X
Lunar Ejecta Meteoroid Experiment	Otto Berg, Goddard Space Flight Center						X
Dust Detector	James Bates, Manned Spacecraft Center	X	X	X			

Lunar Surface Experiment Assignments[59]

Designation	Experiment	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
M-515	Lunar Dust Detector		X	X	X		
S-031	Passive Seismic Experiment	X	X	X	X	X	
S-033	Active Seismic Experiment			X		X	
S-034	Lunar Surface Magnetometer		X		X	X	
S-035	Solar Wind Spectrometer		X		X		
S-036	Suprathermal Ion Detector		X	X	X		
S-037	Heat Flow Experiment				X	X	X
S-038	Charged Particle Lunar Environment			X			
S-058	Cold Cathode Ion Gauge		X	X	X		
S-059	Lunar Field Geology	X	X	X	X	X	X
S-078	Laser Ranging Retroreflector	X		X	X		
S-080	Solar Wind Composition	X	X	X	X	X	
S-151	Cosmic-Ray Detection (helmets)	X					
S-152	Cosmic-Ray Detector (sheets)					X	X
S-184	Lunar Surface Close-up (photography)	X	X	X			
S-198	Portable Magnetometer			X		X	
S-199	Lunar Gravity Traverse						X
S-200	Soil Mechanics			X	X	X	X
S-201	Far-Ultraviolet Camera/Spectroscope					X	
S-202	Lunar Ejecta and Meteorites						X
S-203	Lunar Seismic Profiling						X
S-204	Surface Electrical Properties						X
S-205	Lunar Atmospheric Composition						X
S-207	Lunar Surface Gravimeter						X
S-229	Lunar Neutron Probe						X
---	Lunar Sample Analysis	X	X	X	X	X	X
---	Surveyor III Analysis		X				
---	Long-Term Lunar Surface Exposure						X

59 *Project Apollo:* NASA Facts.

Lunar Surface Experiment Descriptions[60]

Central Station
The heart of the experiment package, provided the radio frequency link to Earth for telemetering data, command/control, and power distribution to the experiments.

Early Apollo Scientific Experiment Package (EASEP)
Flown on Apollo 11 only, this experiment package was powered by solar energy and contained an abbreviated set of experiments. It continued to return data for 71 days.

Active Seismic
Used an astronaut-activated thumper device and mortar firing explosive charges to generate seismic signals. This experiment used geophone seismic listening devices to determine lunar structure to depths of about 1,000 feet.

Heat Flow
Probes containing temperature sensors were implanted in holes to depths of 8 feet to measure the near-surface temperature gradient and thermal conductivity from which heat flow from the lunar interior could be determined.

Lunar Mass Spectrometer
Used a magnetic deflection mass spectrometer to identify lunar atmospheric components and their relative abundance.

Lunar Seismic Profiling
Flown on Apollo 17 only, this experiment was an advanced version of the Active Seismic Experiment. It used four geophones to detect seismic signals generated by eight explosive charges weighing from about 1/10 to 6.5 pounds. The charges were deployed at distances up to 2 nautical miles from the Lunar Module and were detonated by timers after the Lunar Module departed. Lunar structure to depths of 1.5 nautical miles was measured. Used in a listening mode, the experiment continued to provide data on Moon/thermal quakes and meteoroid impacts beyond its planned lifetime

Solar Wind Spectrometer
Measured interaction between the Moon and the solar wind by sensing flow-direction and energies of both electrons and positive ions. Results showed that solar wind plasma measurements on the lunar surface are indistinguishable from simultaneous plasma measurements made by nearby satellites

Suprathermal Ion Detector
Provided information on the energy and mass spectra of positive ions near the lunar surface. Evidence of prompt ionization and acceleration of gases generated on the Moon was found in the return data.

Charged Particle Lunar Environment
Measured the fluxes of charged particles, both electrons and ions, having energies from 50 to 50,000 electron volts. The instrument measured plasma particles originating in the Sun and low-energy particle flux in the magnetic tail of the Earth.

Laser Ranging Retroreflector
The retroreflector bounced laser pulses back to Earth ground stations to provide data for precise measurements of the Earth-Moon distance to determine Earth wobble about its axis, continental drift, lunar librations, etc. Arrays of 100 retroreflecting corners were flown on Apollos 11 and 14, and an array of 300 corners was flown on Apollo 15.

Lunar Surface Magnetometer
Measured the intrinsic remnant lunar magnetic field and the magnetic response of the Moon to large-scale solar and terrestrial magnetic fields. The electrical conductivity of the lunar interior was also determined from measurements of the Moon's response to magnetic field step-transients. Three boom-mounted sensors measured mutually-orthogonal components of the field

Cold Cathode Ion Gauge
A separate experiment combined in an integrated package with the Suprathermal Ion Detector. It determined the density of neutral gas particles in the lunar atmosphere.

Passive Seismic
Detected Moon-quakes and meteoroid impacts to enable scientists to determine the Moon's internal composition.

Radioisotope Thermoelectric Generator
Supplied about 70 watts of electrical power for continuous day-night operation.

Lunar Surface Gravimeter
Measured and sensed changes in the vertical component of lunar gravity, using a spring mass suspension. It also provided data on the lunar tides.

Lunar Ejecta and Meteorites
Three separate detectors which measured energy, speed, and direction of dust particles. Oriented east, west, and up. The dust particles measured were meteorites, secondary ejecta from meteorites, and, possibly, lunar surface particles levitated and accelerated by lunar surface phenomena.

60 *Apollo Lunar Surface Experiments Package (ALSEP): Five Years of Lunar Science and Still Going Strong*, Bendix Aerospace.

Earth Orbit and Lunar Orbit Experiments[61]

Designation	Experiment	Apollo 7	Apollo 8	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
S-151	Cosmic Ray Detector (Helmets)		X		X				
S-158	Multispectral Photography				X				
S-160	Gamma-Ray Spectrometer						X	X	X
S-161	X-Ray Fluorescence						X	X	
S-162	Alpha-Particle Spectrometer						X	X	
S-164	S-Band Transponder (CSM/LM)					X	X	X	X
S-164	S-Band Transponder (Subsatellite)						X	X	
S-165	Mass Spectrometer						X	X	
S-169	Far-Ultraviolet Spectrometer								X
S-170	Bistatic Radar					X	X	X	
S-171	Infrared Scanning Radiometer								X
S-173[62]	Particle Shadows/boundary Layer						X	X	
S-174	Magnetometer						X	X	
S-176	Command Module Window Meteoroid					X	X	X	X
S-177	Ultraviolet Photography, Earth, Moon						X	X	
S-178	Gegenschein from Lunar Orbit					X	X	X	
S-209	Lunar Sounder								X
---	Candidate Exploration Sites				X	X			
---	CM Orbital Science Photography					X			
---	CM Photographic Tasks						X	X	X
---	Dim Light Photography					X			
---	Lunar Mission Photography From CM		X		X	X			
---	Selenodetic Reference Point Update				X	X			
---	SM Orbital Photographic Tasks[63]						X	X	X
---	Synoptic Terrain Photography	X							

61 *Apollo Program Summary Report* (JSC-09423).

62 Experiments S-173 and S-174 were Particles and Fields Subsatellite experiments.

63 Included panoramic camera photography, mapping camera photography, and laser altimetry. Also supported geologic objectives.

---	Synoptic Weather Photography	X					
---	Transearth Lunar Photography			X			
---	Visual Observations From Lunar Orbit				X	X	X

Geology and Soil Mechanics Tools and Equipment[64]

Item	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Apollo Lunar Surface Hand Tools						
Hammer	1	1	1	1	1	1
Large Scoop	1	1	1	0	0	0
Adjustable Scoop	0	0	0	1	1	1
Extension Handle	1	1	1	1	2	2
Gnomon	1	1	1	1	1	1
Tongs	1	1	1	1	2	2
Adjustable Trenching Tool	0	0	1	0	0	0
Rake	0	0	0	1	1	1
Core Tubes	2	4	6	0	0	0
Core Tube Caps	2	1	0	0	0	0
Drive Tubes (Lower)	0	0	0	5	5	5
Drive Tubes (Upper)	0	0	0	4	4	4
Drive Tube Cape and Bracket Assembly	0	0	0	3	5	5
Drive Tube Tool Assembly	0	0	0	0	1	1
Spring Scale	1	1	0	0	0	0
Sample Scale	0	0	1	1	1	1
Tool Carrier	0	0	0	1	1	0
Sample Return Container	2	2	2	2	2	2
Bags and Special Containers						
Small Sample Bags	5	0	0	0	0	0
Documented Sample Bags (15-Bag Dispenser)	1	3	1	0	0	0
Documented Sample Bags (20-Bag Dispenser)	0	0	0	6	7	8
Documented Sample Bags (35-Bag Dispenser)	0	1	2	0	0	0
Round Documented Sample Bag	0	0	0	0	0	48
Protective Padded Sample Bag	0	0	0	0	2	0
Documented Sample Weigh Bag	2	4	4	0	0	0
Sample Collection Bag	0	0	0	2	2	2
Gas Analysis Sample Container	1	1	0	0	0	0
Core Sample Vacuum Container	0	1	3	3	1	1
Solar Wind Composition Bag	2	1	1	0	0	0
Magnetic Shield Sample Container	0	0	1	0	0	0
Extra Sample Collection Bags	0	0	0	4	6	6
Organic Control Sample	0	1	2	2	2	0
Lunar Surface Sampler (Beta Cloth)	0	0	0	0	1	0
Lunar Surface Sampler (Velvet)	0	0	0	0	1	0
Lunar Rover Vehicle Soil Sampler	0	0	0	0	0	1
Magnetic Sample Assembly	0	0	0	0	1	0
Tether Hook	1	1	1	0	0	0
Lunar Surface Drill	0	0	0	1	1	1
Core Stem With Bit	0	0	0	1	1	1
Core Stems Without Bit	0	0	0	5	5	5
Core Stem Cap and Retainer Assembly	0	0	0	2	2	2
Self-Recording Penetrometer	0	0	0	1	1	0

64 *Apollo Program Summary Report* (JSC-09423), page 3-27.

Lunar Subsatellites[65]

	Apollo 15	Apollo 16
Designations		
International	1971 063D	1972 031D
NORAD	05377	06009
Deploy Conditions		
GET	222:39:29.1	196:02:09
KSC Date	04 Aug 1971	24 Apr 1972
GMT Date	04 Aug 1971	24 Apr 1972
KSC Time	04:13:29 p.m.	04:56:09 p.m.
KSC Time Zone	EDT	EST
GMT Time	20:13:29	21:56:09
CM Revolution at Deploy	74	62
Weight (lbs)	78.5	90
Apolune (n mi)	76.3	66
Perilune (n mi)	55.1	52
Inclination (deg)	151.28	169.2810
Period (min)	119.75	119
Flight Path Angle (deg)	-0.60	-0.41
Heading Angle (deg)	-41.78	-79.43
Eccentricity	0.00935	0.0108
Weight (lbm)	79	93
Status	Selenocentric orbit, 1984	Impacted lunar surface
GET (hh:mm)	[Unknown]	1,034:37
KSC Date	[Unknown]	29 May 1972
GMT Date	22 January 1973 (ground support terminated)	29 May 1972
KSC Time	[Unknown]	03:31 p.m. EDT
GMT Time	[Unknown]	20:31
Revolutions	[Unknown]	425
Lunar Impact Latitude (°N)	[Unknown]	[Unknown]
Lunar Impact Longitude (°E)	[Unknown]	110

65 Compiled from *Apollo 15 Preliminary Science Report* (SP-289); *Apollo 16 Preliminary Science Report* (SP-315); National Space Science Data Center (NSSDC) at the Goddard Space Flight Center, MD; and mission reports.

Entry, Splashdown, and Recovery[66]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17[67]
Earth Entry											
GET	259:53:26	146:46:12.8	240:44:10.2	191:48:54.5	195:03:05.7	244:22:19.09	142:40:45.7	215:47:45	294:58:54.7	265:37:31	301:38:38
Velocity (ft/sec)	25,846.4	36,221.1	25,894	36,314	36,194.4	36,116.618	36,210.6	36,170.2	36,096.4	36,196.1	36,090.3
Maximum Entry Velocity (ft/sec)	25,955	36,303	25,989	36,397	36,277						
Maximum g	3.33	6.84	3.35	6.78	6.56	6.57	5.56	6.76	6.23	7.19	6.49
Range (n mi)	1,594	1,292	1,835	1,295	1,497	1,250	1,250	1,234	1,184	1,190	1,190
Geodetic Latitude (°N)	-29.92	20.83	33.52	-23.60	-3.19	-13.80	-28.23	-36.36	14.23	-19.87	0.71
Longitude (°E)	92.62	-179.89	-99.05	174.39	171.96	173.52	173.44	165.80	-175.02	-162.13	-173.34
Flight Path Angle (°)	-2.0720	-6.50	-1.74	-6.54	-6.48	-6.48	-6.269	-6.370	-6.51	-6.55	-6.49
Heading Angle (° E of N)	87.47	121.57	99.26	71.89	50.18	98.16	77.21	70.84	52.06	21.08	156.53
Lift To Drag Ratio	---	0.300	---	0.305	0.300	0.309	0.291	0.280	0.290	0.286	0.290
Max. Heating Rate ($BTU/ft^2/sec$)	---	296	---	296	286	285	271	310	289	346	346
Total Heating Load (BTU/ft^2)	---	26,140	---	25,728	26,482	26,224	25,710	27,111	25,881	27,939	27,939
Duration (sec)	937.0	869.2	1,003.8	868.5	929.3	845.9	835.3	852.8	778.3	814.0	801.0
Avg. Radiation Skin Dose (Rads)	0.16[68]	0.16	0.20	0.48	0.18	0.58	0.24	1.14	0.30	0.51	0.55
Earth Splashdown											
GET	260:09:03	147:00:42.0	241:00:54	192:03:23	195:18:35	244:36:25	142:54:41	216:01:58.1	295:11:53.0	265:51:05	301:51:59
KSC Date	22 Oct 1968	27 Dec 1968	13 Mar 1969	26 May 1969	24 Jul 1969	24 Nov 1969	17 Apr 1970	09 Feb 1971	07 Aug 1971	27 Apr 1972	19 Dec 1972
GMT Date	22 Oct 1968	27 Dec 1968	13 Mar 1969	26 May 1969	24 Jul 1969	24 Nov 1969	17 Apr 1970	09 Feb 1971	07 Aug 1971	27 Apr 1972	19 Dec 1972
KSC Time	07:11:48 a.m.	10:51:42 a.m.	12:00:54 p.m.	12:52:23 a.m.	12:50:35 p.m.	03:58:25 p.m.	01:07:41 p.m.	04:05:00 p.m.	04:45:53 p.m.	02:45:05 p.m.	02:24:59 p.m.
Time Zone	EDT	EST	EST	EDT	EDT	EST	EST	EST	EDT	EST	EST

66 Compiled from mission reports, USN Historical Office data, *Apollo Program Summary Report* (JSC-09423) and other sources.

67 Some Apollo 17 entry phase data are preflight predictions because actual data were not obtained.

68 *Space Physiology & Medicine*, SP-447.

GMT Time	11:11:48	15:51:42	17:00:54	16:52:23	16:50:35	20:58:25	18:07:41	21:05:00	20:45:53	19:45:05	19:24:59
Splashdown Site (Ocean)	Atlantic	Pacific	Atlantic	Pacific	Pacific	Pacific	Pacific	Pacific	Pacific	Pacific	Pacific
Latitude (°N)	27.63	8.10	23.22	-15.07	13.30	-15.78	-21.63	-27.02	26.13	-0.70	-17.88
Longitude (°E)	-64.15	-165.00	-67.98	-164.65	-169.15	-165.15	-165.37	-172.67	-158.13	-156.22	-166.11
CM Weight (lbm)	11,409	10,977	11,094	10,901	10,873.0	11,050.2	11,132.9	11,481.2	11,731	11,995	12,120
Distance To Target (n mi)	1.9	1.4	2.7	1.3	1.7	2.0	1.0	0.6	1.0	3.0	1.0
Distance To Recovery Ship (n mi)	7	2.6	3	2.9	13	3.91	3.5	3.8	5	2.7	3.5
Distance Traveled (n mi)	3,953,842	504,006	3,664,820	721,250	828,743	828,134	541,103	1,000,279	1,107,945	1,208,746	1,291,299
Maximum Distance Traveled From Earth (n mi)	244.2	203,752.37	275.0	215,548	210,391	---	---	---	---	---	---

Entry, Splashdown, and Recovery[69]

	Apollo 8	Apollo 9	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Splashdown Weather									
1st Level Cloud Type	Scattered	30%	---	---	Broken	High Scattered	Scattered	Scattered	Scattered
1st Level Cloud Cover (ft)	2,000	2,000	---	---	2,000	2,000	2,000	2,000	3,000
2nd Level Cloud Type	Overcast	Broken	---	---	---	---	---	---	---
2nd Level Cloud Cover (ft)	9,000	9,000	---	---	---	---	---	---	---
Visibility (n mi)	10	10	12	10	10	10	10	10	10

69 Compiled from mission reports, USN Historical Office data, *Apollo Program Summary Report* (JSC-09423) and other sources.

Wind Speed (ft/sec)	32	15	27						
Wind Speed (knots)	19	9	16	15	10	15	10	10	10
Wind Direction (deg from True N)	70	200		68				110	130
Air Temperature (°F)	---	79	---	---	---	---	---	---	---
Water Temperature (°F)	82	76	---	---	---	---	---	---	---
Wave Height (ft)	6	7	3	3, 15 ft swells	4	4	3	4	2 to 3
Wave Direction (deg from True N)	110	340	---	---	---	---	---	---	---
Crew Recovery									
Minutes To Crew Pickup	88	49	63	60	45	48	39	37	52
Launch Site Pickup Time	12:20 p.m.	12:49:33 p.m.	01:53 p.m.	04:58 p.m.	01:53 p.m.	04:53 p.m.	05:25 p.m.	03:22 p.m.	03:17 p.m.
Time Zone	EST	EST	EDT	EST	EST	EST	EDT	EST	EST
GMT Pickup Time	17:20	17:49:33	17:53	21:58	18:53	21:53	21:25	20:22	20:17
Recovery Ship	*Yorktown* (CVS-10)	*Guadalcana*l (LPH-7)	*Hornet* (CVS-12)	*Hornet* (CVS-12)	*Iwo Jima* (LPH-2)	*New Orleans* (LPH-11)	*Okinawa* (LPH-3)	*Ticonderoga* (CVS-14)	*Ticonderoga* (CVS-14)
Commanding Officer (Captain)	John G. Fifield	Roy M. Sudduth	Carl J. Seiberlich	Carl J. Seiberlich	Leland E. Kirkemo	Robert W. Carius	Andrew F. Huff	Frank T. Hamler	Frank T. Hamler

Spacecraft Recovery

Flotation Attitude	Inverted	Upright	Inverted	Inverted	Upright	Upright	Upright	Inverted	Upright
Minutes To Upright	6.0	0.0	7.6	4.5	0.0	0.0	0.0	4.5	0.0
Minutes To CM Pickup	148	132	188	108	88	124	94	99	123
Launch Site Pickup Time	01:20 p.m.	02:13 p.m.	03:58 p.m.	05:46 p.m.	02:36 p.m.	06:09 p.m.	06:20 p.m.	04:24 p.m.	04:28 p.m.
Time Zone	EST	EST	EDT	EST	EST	EST	EDT	EST	EST
GMT Pickup Time	18:20	19:13	19:58	22:46	19:36	23:09	22:20	21:24	21:28
Navy Ships Deployed	12	6	5	5	4	5	4	4	3
Atlantic	6	3	3	3	2	3	2	1	1
Pacific	6	3	2	2	2	2	2	3	2
Aircraft Deployed	43	29	31	26	22	19	17	17	15
Navy	21	7	13	9	8	5	5	6	5
Air Force	22	22	18	17	14	14	12	11	10

Selected Mission Weights (lbs)[70]

	Apollo 8	Apollo 9	Apollo 11	Apollo 12	Apollo 14	Apollo 15	Apollo 16	Apollo 17
CSM/LM at EOI	87,382	95,231	100,756.4	101,126.9	102,083.6	107,142	107,226	107,161
CSM/LM at Separation	---	---	96,566.6	---	---	---	---	---
CSM/LM at Transposition & Docking	---	91,055	96,767.5	97,119.8	98,037.2	103,105	103,175	103,167
CSM at Transposition & Docking	---	58,925	63,473.0	63,535.6	64,388.0	66,885	66,923	66,893
LM at Transposition & Docking	---	32,130	33,294.5	33,584.2	33,649.2	36,220	36,252	36,274
CSM/LM at 1st MCC Ignition	63,307	---	96,418.2	96,870.6	97,901.5	---	---	---
CSM/LM at 1st MCC Cutoff	---	---	96,204.2	96,401.2	---	---	---	---

70 Compiled from mission reports. Apollo 7 and Apollo 8 did not have a LM. Apollo 13 includes CSM and LM until separation before Earth entry.

CSM/LM Before Cryogenic Tank Anomaly	---	---	---	---	---	---	---	---
CSM/LM After Cryogenic Tank Anomaly	---	---	---	---	---	---	---	---
CSM/LM at 2nd MCC Ignition	62,845	---	---	---	97,104.1	---	---	---
CSM/LM at 2nd MCC Cutoff	---	---	---	---	---	---	---	---
CSM at TEI Ignition	45,931	---	36,965.7	34,130.6	34,554.4	35,899	38,697	36,394
CSM at TEI Cutoff	---	---	26,792.7	25,724.5	---	---	---	---
CSM at 3rd MCC Ignition	32,008	---	---	---	24,631.9	---	---	---
CSM at 3rd MCC Cutoff	---	---	---	---	---	---	---	---

CSM/LM at LOI Ignition	62,827	---	96,061.6	96,261.1	97,033.1	102,589	102,642	102,639
CSM/LM at LOI Cutoff	46,743	---	72,037.6	72,335.6	71,823.0	76,329	77,647	76,540
CSM/LM at Circularization Ignition	46,716	---	72,019.9	72,243.7	---	---	---	---
CSM/LM at Circularization Cutoff	---	---	70,905.9	71,028.4	---	---	---	---
CSM/LM at Descent Orbit Insertion	---	---	---	---	71,768.8	76,278	77,595	76,354
CSM/LM at Separation for Lunar Landing	---	---	70,760.3	70,897.3	70,162.3	74,460	76,590	74,762
CSM at Separation for Lunar Landing	---	---	37,076.8	36,911.8	36,036.4	37,742	39,847	37,991
LM at Separation for Lunar Landing	---	---	33,683.5	33,985.5	34,125.9	36,718	36,743	36,771
LM at Powered Descent Initiation	---	---	---	---	34,067.8	36,634	36,617	36,686
LM at Descent Orbit Insertion Ignition	---	---	33,669.6	33,971.8	---	---	---	---
LM at Descent Orbit Insertion Cutoff	---	---	33,401.6	33,719.3	---	---	---	---
LM at Lunar Landing	---	---	16,153.2	16,564.2	16,371.7	18,175	18,208	18,305
CSM at Plane Burn Time	---	---	---	---	35,610.4	37,219	38,994	37,464

CSM at Circularization Ignition	---	---	---	---	35,996.3	37,716	39,595	37,960
LM at Phasing Ignition	---	---	---	---	---	---	---	---
LM at Phasing Cutoff	---	---	---	---	---	---	---	---
LM at Fuel Depletion	---	5,616	---	---	---	---	---	---
CSM/LM Ascent Stage at Docking	---	36,828	42,585.4	41,071.8	39,906.8	41,754	44,318	41,914
CSM at Docking	---	26,895	36,847.4	35,306.2	34,125.5	35,928	38,452	36,036
LM Ascent Stage at Lunar Liftoff	---	---	10,776.6	10,749.6	10,779.8	10,915	10,949	10,997
LM Ascent Stage at Orbit Insertion for Docking	---	---	5,928.6	5,965.6	5,917.8	5,985	6,001	6,042
LM Ascent Stage at Terminal Phase Initiation	---	---	---	---	5,880.1	5,965	5,972	5,970
LM Ascent Stage After Staging	---	---	---	---	---	---	---	---
LM Ascent Stage at Coelliptic Sequence Initiation	---	---	5,881.5	5,885.9	---	---	---	---
LM Ascent Stage at Docking	---	9,933	5,738.0	5,765.6	5,781.3	5,826	5,866	5,878
CSM at After Post-Docking Jettison	---	27,139	37,100.5	35,622.9	34,596.3	36,407	38,992	36,619
LM Ascent Stage After Post-Docking Jettison	---	---	5,462.5	5,436.5	5,307.6	5,325	5,306	5,277

CSM (CSM/LM) at Subsatellite Jettison	---	---	---	---	---	36,019	38,830	---
CSM at 4th MCC Ignition	---	---	---	---	---	---	---	---
CSM at 4th MCC Cutoff	---	---	---	---	---	---	---	---
CSM at Pre-Entry Separation	31,768	24,183	26,656.5	25,444.2	24,375.0	26,323	27,225	26,659
CSM/LM Before CSM/LM Separation	---	---	---	---	---	---	---	---
CM/LM After CSM/LM Separation	---	---	---	---	---	---	---	---
SM After Pre-Entry Separation	19,589	11,924	14,549.1	13,160.7	11,659.9	13,358	14,199	13,507
CM After Pre-Entry Separation	12,179	12,259	12,107.4	12,283.5	12,715.1	12,965	13,026	13,152
CM at Entry	12,171	12,257	12,095.5	12,275.5	12,703.5	12,953	13,015	13,140
CM at Drogue Deployment	11,712	11,839	11,603.7	11,785.7	---	---	---	---

CM at Main Parachute Deployment	11,631	11,758	11,318.9	11,496.1	12,130.8	12,381	12,442	12,567
CM at Landing	10,977	11,094	10,873.0	11,050.2	11,481.2	11,731	11,995	12,120

Command Module Cabin Temperature History (°F)[71]

Mission	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Launch	70	65	65	75	70	70	70	70	70	70	70
Average	70	72	70	73	63	67	64	74	69	70	69
High	79	81	72	80	73	80	71	77	81	80	81
Low	64	61	65	64	55	58	43	60	59	57	61
Reentry	65	61	67	58	55	60	75	59	59	57	6

71 *Biomedical Results of Apollo*, SP-368, p. 133. All temperatures were measured at the heat exchanger inlet. During the Apollo 13 mission, the LM environmental control system provided a habitable environment for about 83 hours (57:45 to 141:05 GET). Cabin temperature remained low due to low electrical power levels. This caused crew discomfort during much of this period. The source noted shows the low mission temperature as 58 °F; however, this may be for times when the CM was powered up. Further research suggests that the low temperature was 43 °F, which is used in the table above.

Accumulated Time in Space During Apollo Missions[72]

	Apollo 8	Apollo 9	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17	Flight Time (sec)	Flight Time (hh:mm:ss)
Mission Duration (hh:mm:ss)	147:00:42	241:00:54	195:18:35	244:36:25	142:54:41	216:01:58	295:11:53	265:51:05	301:51:59		
Mission Duration (sec)	529,242	867,654	703,115	880,585	514,481	777,718	1,062,713	957,065	1,086,719		
David Randolph Scott		867,654					1,062,713			1,930,367	536:12:47
Eugene Andrew Cernan									1,086,719	1,778,122	493:55:22
John Watts Young								957,065		1,648,468	457:54:28
Ronald Ellwin Evans									1,086,719	1,086,719	301:51:59
Harrison Hagan Schmitt									1,086,719	1,086,719	301:51:59
James Benson Irwin							1,062,713			1,062,713	295:11:53
Alfred Merrill Worden							1,062,713			1,062,713	295:11:53
James Arthur Lovell, Jr.	529,242				514,481					1,043,723	289:55:23

72 All times are calculated from Range Zero to splashdown for each mission.

				4, 4 8 1				
Charles Moss Duke, Jr.						957,065	957,065	265:51:05
Thomas Kenneth Mattingly, II						957,065	957,065	265:51:05
Ronnie Walter Cunningham							936,543	260:09:03
Donn Fulton Eisele							936,543	260:09:03
Walter Marty Schirra, Jr.							936,543	260:09:03
Alan LaVern Bean				880,585			880,585	244:36:25
Charles Conrad, Jr.				880,585			880,585	244:36:25
Richard Francis Gordon, Jr.				880,585			880,585	244:36:25
James Alton McDivitt		867,654					867,654	241:00:54
Russell Louis Schweickart		867,654					867,654	241:00:54
Edgar Dean Mitchell					777,718		777,718	216:01:58
Stuart Allen Roosa					777,718		777,718	216:01:58
Alan Bartlett Shepard, Jr.					777,718		777,718	216:01:58
Edwin Eugene Aldrin, Jr.			703,115				703,115	195:18:35
Neil Alden Armstrong			703,115				703,115	195:18:35
Michael Collins			703,115				703,115	195:18:35
Thomas Patten Stafford							691,403	192:03:23
William Alison Anders	529,242						529,242	147:00:42
Frank Frederick Borman, II	529,242						529,242	147:00:42
Fred Wallace Haise, Jr.				5 1 4, 4 8			514,481	142:54:41

John Leonard Swigert, Jr.				15144,481					514,481	142:54:41
Total Man-Seconds From Liftoff	**1,587,726**	**2,602,962**	**2,109,345**	**2,641,7551,543,443**	**2,333,154**	**3,188,1392,871,195**		**3,260,157**	**27,021,714**	
Total Time In Space (hh:mm:ss)	**441:02:06**	**723:02:42**	**585:55:45**	**733:49:15**	**648:05:54**	**885:35:39**	**797:33:15**	**905:35:57**	**7,506:01:54**	**7,506:01:54**

Apollo Medical Kits[73]

Values after a "/" indicate quantity of in-flight usage.

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Command Module Medical Kit											
Methylcellulose eye drops (0.25%)	2/1	2/2	2/0	2/0	2/0	2/0	2/0	2/0	1/0	2/0	1/0
Tetrahydrozoline HCl (Visine)	---	---	---	---	---	---	---	---	---	---	1/1
Compress - bandage	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0
Band-Aids®	12/2	12/0	12/0	12/0	12/0	12/0	12/0	12/0	12/0	12/0	12/0
Antibiotic ointment	1/1	1/0	1/0	1/0	1/0	2/0	2/0	2/0	2/0	2/1	2/1
Skin cream	1/0	1/1	1/1	1/0	1/0	1/0	1/0	1/0	1/0	1/1	1/0
Demerol injectors (90 mg)	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	---	---
Marezine injectors	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	---	---
Marezine tablets (50 mg)	24/3	24/1	24/4	12/0	---	---	---	---	---	---	---
Dexedrine tablets (5 mg)	12/1	12/0	12/0	12/0	12/0	12/0	12/1	12/0	12/0	12/0	12/0
Darvon compound caps (60 mg)	12/2	18/0	18/0	18/0	18/0	18/0	12/1	18/0	18/0	18/0	18/0
Actifed® tablets (60 mg)	24/24	60/0	60/12	60/2	60/0	60/18	60/0	60/0	60/0	60/0	60/1
Lomotil tablets	24/8	24/3	24/1	24/13	24/2	24/0	24/1	24/0	24/0	24/0	48/5
Nasal emollient	1/0	2/1	2/1	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0
Aspirin tablets (5 gr)	72/48	72/8	72/2	72/16	72/Unk	72/6	72/30	72/0	72/0	72/0	72/0
Tetracycline (250 mg)	24/02	24/0	24/0	15/0	---	---	---	---	60/0	60/0	60/0
Ampicillin	---	60/0	60/0	45/0	60/0	60/0	60/0	60/0	60/0	60/0	60/0
Seconal® capsules (100 mg)	---	21/1	21/10	21/0	21/0	21/6	21/0	---	21/0	21/3	21/16
Seconal® capsules (50 mg)	---	12/7	---	---	---	---	---	---	---	---	---
Nose drops (Afrin™)	---	3/0	3/1	3/0	3/0	3/1	3/0	3/1	3/0	3/0	3/3
Benadryl® (50 mg)	---	8/0	---	---	---	---	---	---	---	---	---
Tylenol® (325 mg)	---	14/7	---	---	---	---	---	---	---	---	---
Bacitracin eye ointment	---	---	1/0	---	---	---	---	---	---	---	---
Scopolamine (0.3 mg) - Dexedrine (5 mg capsules)	---	---	---	---	12/6	12/0	12/2	12/0	12/0	12/0	12/1
Mylicon tablets	---	---	---	---	40/0	40/0	40/0	40/0	40/0	40/0	40/0
Opthaine	---	---	---	---	---	---	1/0	1/0	1/0	1/0	1/0
Multi-Vitamins	---	---	---	---	---	---	---	20/0	---	---	---
Auxiliary Medications											
Pronestyl	---	---	---	---	---	---	---	---	---	80/0	80/0
Lidocaine	---	---	---	---	---	---	---	---	---	12/0	12/0
Atropine	---	---	---	---	---	---	---	---	---	12/0	12/0
Demerol™	---	---	---	---	---	---	---	---	---	6/0	6/0

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Apollo Medical Kits[74]

	Apollo 7	Apollo 8	Apollo 9	Apollo 10	Apollo 11	Apollo 12	Apollo 13	Apollo 14	Apollo 15	Apollo 16	Apollo 17
Apollo Medical Accessories Kit											
Constant Wear Garment	---	---	---	---	---	---	---	---	3	3	3
Harness Plug											
ECG Sponge Packages	---	---	---	---	---	---	---	---	14	14	14
Electrode Bag	1	1	1	1	1	1	1	1	1	1	1
Electrode Attachment Assembly	12	12	12	12	20	20	20	20	100	100	100
Micropore Disc	12	12	12	12	20	20	20	20	50	50	50
Sternal Harness	1	1	1	1	3	3	3	3	3	3	3
Axillary Harness	1	1	1	1	1	1	1	1	1	1	1
Electrode Paste	1	1	1	1	1	1	1	1	1	1	1
Oral Thermometer	1	1	1	1	1	1	1	1	1	1	1
pH Paper Urine	1	1	1	1	1	1	1	1	1	None	None
Collection and Transfer Assembly	3	3	6	6	6	6	6	6	6	6	6
Roll-On Cuffs											
Lunar Module Medical Kit[75]											
Rucksack	---	---	---	---	---	1					
Stimulant Pill s (Dexedrine®)	---	---	---	---	---	4					
Pain Pills (Darvon®)	---	---	---	---	---	4					
Decongestant Pills (Actifed®)	---	---	---	---	---	8					
Diarrhea Pills (Lomotil®)	---	---	---	---	---	12					
Aspirin	---	---	---	---	---	12					
Band-Aids	---	---	---	---	---	6					
Compress Bandages	---	---	---	---	---	2					
Eye Drops	---	---	---	---	---	1					

74 *Biomedical Results of Apollo*, NASA SP-368, p. 33.

75 Typical quantities and items; there was no “standard” LM medical kit. The adequacy of the kits was reviewed after each mission and appropriate modifications were made for the next mission.

(Methylcellulose)						
Antibiotic Ointment (Neosporin®)	---	---	---	---	---	1
Sleeping Pills (Seconal®)	---	---	---	---	---	6
Anesthetic Eye Drops	---	---	---	---	---	1
Nose Drops (Afrin®)	---	---	---	---	---	1
Urine Collection and Transfer Assembly	---	---	---	---	---	6
Roll-On Cuffs						
Pronestyl Injectable Drug Kit	---	---	---	---	---	12
Injectable Drug Kit	---	---	---	---	---	1
Rucksack						
Lidocaine (cardiac)	---	---	---	---	---	8
Atropine (cardiac)	---	---	---	---	---	4
Demerol (pain)	---	---	---	---	---	2

Crew Weight History (kg)[76]

Mission	Crewman	30 Days Before Launch	30-Day Average	Launch	Recovery
Apollo 7	Schirra	87.1	87.8	88.0	86.1
	Eisele	69.4	69.5	71.2	66.7
	Cunningham	69.4	70.7	70.8	67.8
Apollo 8	Borman	76.2	76.6	76.6	72.8
	Lovell	76.4	76.8	78.0	74.4
	Anders	66.0	66.4	64.4	62.6
Apollo 9	McDivitt	73.5	73.0	72.1	69.6
	Scott	82.8	82.0	80.7	78.2
	Schweickart	74.7	74.3	71.2	69.4
Apollo 10	Stafford	80.1	79.6	77.6	76.4
	Young	76.6	76.8	74.8	72.3
	Cernan	79.4	79.4	78.5	73.9
Apollo 11	Armstrong	78.0	78.4	78.0	74.4
	Collins	74.4	75.6	75.3	72.1
	Aldrin	77.6	78.1	75.7	75.3
Apollo 12	Conrad	66.2	66.6	67.7	65.8
	Gordon	71.0	70.7	70.4	67.1
	Bean	69.4	69.9	69.1	63.5
Apollo 13	Lovell	79.8	78.7	80.5	74.2
	Swigert	89.1	89.4	89.3	84.4
	Haise	71.0	70.8	70.8	67.8
Apollo 14	Shepard	78.0	78.4	76.2	76.6
	Roosa	74.2	75.3	74.8	69.4
	Mitchell	83.5	83.2	79.8	80.3
Apollo 15	Scott	80.5	81.1	80.2	78.9
	Worden	73.7	73.6	73.5	72.1
	Irwin	74.3	74.3	73.2	70.8
Apollo 16	Young	80.8	80.1	78.9	75.5
	Mattingly	63.2	62.6	61.5	58.5
	Duke	73.1	73.2	73.0	70.5
Apollo 17	Cernan	81.0	80.7	80.3	76.1
	Evans	78.2	77.3	75.7	74.6
	Schmitt	76.0	76.0	74.8	72.9

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Inflight Medical Problems in Apollo Crews[77]

Symptom/Finding	Etiology	Cases
Barotitis	Barotrauma	1
Cardiac arrhythmia	Undetermined, possibly linked with potassium deficit	2
Dehydration	Reduced water intake during emergency	2
Dysbarism (bends)[78]	Undetermined	1
Excoriation, urethral meatus	Prolonged wearing of urine collection device	2
Eye irritation	Spacecraft atmosphere	4
	Fiberglass	1
Flatulence	Undetermined	3
Genitourinary infection with prostatic congestion	Pseudomonas aeruginosa	1
Head cold	Undetermined	3
Headache	Spacecraft environment	1
Nasal stuffiness	Zero gravity	2
Nausea, vomiting	Labyrinthine	1
	Undetermined (possibly virus-related)	1
Pharyngitis	Undetermined	1
Rash, facial, recurrent inguinal	Contact dermatitis	1
	Prolonged wearing of urine collection device	1
Respiratory irritation	Fiberglass	1
Rhinitis	Oxygen, low relative humidity	2
Seborrhea	Activated by spacecraft environment	2
Shoulder strain	Lunar core drilling	1
Skin irritation	Biosensor sites	11
	Fiberglass	2
	Undetermined	1
Stomach awareness	Labyrinthine	6
Stomatitis	Aphthous ulcers	1
Subungual hemorrhages	Glove fit	5
Urinary tract infection	Undetermined	1

77 *Biomedical Results of Apollo*, SP-368.

78 Also occurred during Gemini 10; later incidences were reported by the same crewman five years after his Apollo mission.

Postflight Medical Problems in Apollo Crews[79]

Diagnosis	Etiology	Cases
Barotitis media	Eustachian tube blockage	7
Folliculitis, right anterior chest	Bacterial	1
Gastroenteritis	Bacterial	1
Herpetic lesion, lip	Herpes virus	1
Influenza syndrome	Influenza B virus	1
	Undetermined	1
	Influenza A virus	1
Laceration of the forehead	Trauma	1
Rhinorrhea, mild	Fiberglass particle	1
Papular lesions, parasacral	Bacteria	1
Prostatitis	Undetermined	2
Pulpitis, tooth No. 7		1
Pustules, eyelids		1
Rhinitis	Viral	3
Acute maxillary sinusitis	Bacterial	1
Ligamentous strain, right shoulder		1
Urinary tract infection	Pseudomonas	1
Vestibular dysfunction, mild		1
Rhinitis and pharyngitis	Influenza B virus	1
Rhinitis and secondary bronchitis	Beta-streptococcus (not group A)	1
Contact dermatitis	Fiberglass	1
	Beta cloth	1
	Micropore tape	6
Subungual hemorrhages, finger nails	Trauma	3

79 *Biomedical Results of Apollo*, NASA SP-368.

Baseline Apollo Food and Beverage List[80]

Abbreviations
RSB – rehydratable spoon bowl
RD – rehydratable drink
IM – intermediate moisture
D – dehydrated
T – thermostabilized
NS – natural state

Beverages
Cocoa (RD)
Coffee (RD)
Grape Drink (RD)
Grapefruit Drink (RD)
Orange-Grapefruit Drink (RD)
Orange Juice (RD)
Pineapple-Grapefruit drink (RD)
Pineapple-Orange drink (RD)

Breakfast Items
Bacon squares [8] (IM)
Cinnamon Toasted Bread Cubes [4] (D)
Canadian Bacon and Applesauce (RSB)
Cornflakes (RSB)
Fruit Cocktail (RSB)
Sausage Patties (RSB)
Scrambled Eggs (RSB)
Peaches (RSB)
Spiced Fruit Cereal (RSB)
Apricot (IM)
Peaches (IM)

Cubes and Candy
Brownies [4] (IM)
Caramel Candy (IM)
Chocolate Bar (IM)
Creamed Chicken Bites [6] (IM)
Cheese Crackers (D)
Cheese Sandwiches [4] (D)
Beef Sandwiches [4] (D)
Jellied Fruit Candy (IM)
Beef Jerky (IM)
Peanut Cubes [4] (NS)
Pecans [6] (IM)
Pineapple Fruitcake (IM)
Sugar Cookies [4] (D)
Turkey Bites [4] (D)

Desserts
Applesauce (RSB)
Banana Pudding (RSB)
Butterscotch Pudding (RSB)
Chocolate Pudding (RSB)
Cranberry-Orange Sauce (RSB)
Peach Ambrosia (RSB)

Salads and Soups
Chicken and Rice Soup (RSB)
Lobster Bisque (RSB)
Pea Soup (RSB)
Potato Soup (RSB)
Shrimp Cocktail (RSB)
Tomato Soup (RSB)
Tuna Salad (RSB)

Sandwich Spreads and Bread
Bread [Slice] (NS)
Catsup (NS)
Cheddar Cheese [2 oz] (NS)
Chicken Salad [8 oz] (T)
Ham Salad [8 oz] (T)
Jelly (NS)
Mustard (NS)
Peanut Butter (NS)

Meats
Beef Pot Roast (RSB)
Beef and Vegetables (RS)
Beef Stew (RSB)
Chicken and Rice (RSB)
Chicken and Vegetables (RSB)
Chicken Stew (RSB)
Pork and Scalloped Potatoes (RSB)
Spaghetti, Meat Sauce (RSB)
Beef and Gravy (T)
Frankfurters (T)
Meatballs, Sauce (T)
Turkey and Gravy (T)

80 Lyndon B. Johnson Center Flight Crew Support Division.

NASA Photo Numbers For Crew Portraits and Mission Insignias[81]

Image	NASA Photo #
Apollo Program Insignia	S65-55202
Apollo 1 Mission Insignia	S66-36742
Portrait of Apollo 1 Prime Crew	S66-30236
Apollo 7 Mission Insignia	S68-26668
Portrait of Apollo 7 Prime Crew	S68-33744
Apollo 8 Mission Insignia	S68-51093
Portrait of Apollo 8 Prime Crew	S68-53187
Apollo 9 Mission Insignia	S69-19974
Portrait of Apollo 9 Prime Crew	S69-17590
Apollo 10 Mission Insignia	S69-31959
Portrait of Apollo 10 Prime Crew	S69-34385
Apollo 11 Mission Insignia	S69-34875
Portrait of Apollo 11 Prime Crew	S69-31739
Apollo 12 Mission Insignia	S69-52336
Portrait of Apollo 12 Prime Crew	S69-38852
Apollo 13 Mission Insignia	S69-60662
Portrait of Apollo 13 Original Prime Crew	S69-62224
Portrait of Apollo 13 Flight Crew	S70-36485
Apollo 14 Mission Insignia	S70-17851
Portrait of Apollo 14 Prime Crew	S70-55387
Apollo 15 Mission Insignia	S71-30463
Portrait of Apollo 15 Prime Crew	S71-37963
Apollo 16 Mission Insignia	S71-56246
Portrait of Apollo 16 Prime Crew	S72-16660
Apollo 17 Mission Insignia	S72-49079
Portrait of Apollo 17 Prime Crew	S72-50438

81 Crew photo numbers are for the examples used in “Apollo by the Numbers”; other portrait poses exist.

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